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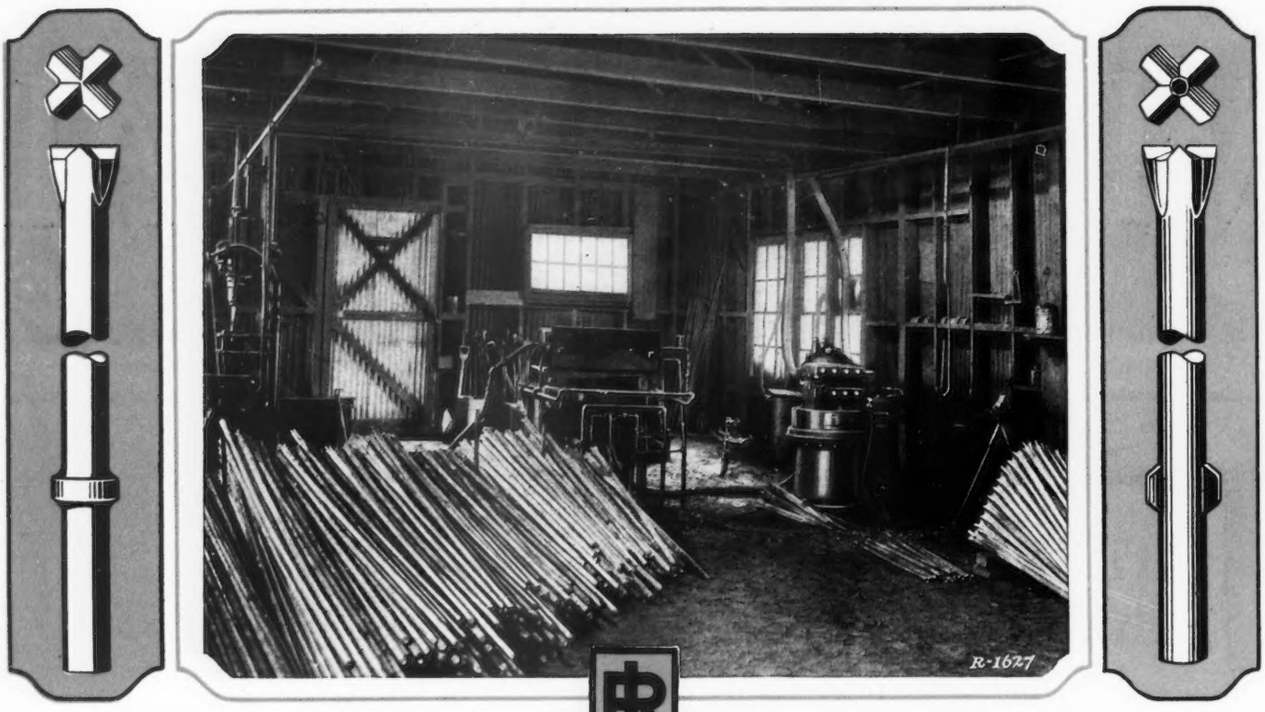

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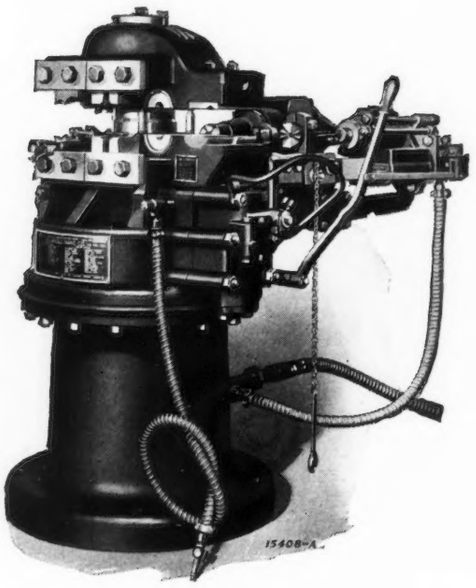

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The Engineer as a Molder of Public Opinion

SECRETARY HOOVER'S lead as a candidate for the Presidency grows with each passing day. His friends expected this, for a fuller recognition of his personal worth and character and his unmatched official record resulted in a popular demand for his selection as soon as the issue was defined. In such a situation, however, there is danger, as all experienced observers of matters political have repeatedly recorded—often with regret. Seasoned and skillful politicians and all well-informed citizens know that overconfidence in politics has lost more battles than it has won. Therefore it behooves everyone who favors Mr. Hoover's election to bestir himself to assure success for the Secretary in November.

The choice of Mr. Hoover as President should result naturally from that fortunate combination of circumstances which makes his selection essential to the best interests of the country. In the words of a time-worn phrase, he is the "logical candidate." The term never fitted any man more thoroughly. With politics what it is, and with ambition gnawing at the souls of numerous "favorite sons," and their followers, beneficiaries, and residuary legatees, no man—be his popularity however well deserved—can expect unanimity of opinion and undivided political purpose.

Though many mining engineers and other professional men identified with the mining industries have given conspicuously of their time and ability to the public service and in promotion of the common good, the very nature of the customary employment of the consulting professional precludes, for many men in the industry, residence in one state long enough to qualify for registration. Many mining engineers change their business base so frequently that they are disfranchised. Formerly this circumstance was accepted as a matter of course; but the election this year—for all engineers—is a special and unusual occasion. One of their number—a leading citizen of the world—is a candidate for the greatest post of honor and service that civilization's political and social development has evolved. The duty of franchised members of the profession of engineering is plain—to vote and to urge others to vote, even if a journey to the place of registration is necessary. Make your plans ahead of time. Exert every possible influence in Mr. Hoover's behalf. Insist on a recognition of his qualities, with the conviction that your influence and your labor are not alone to promote the candidacy of the man best fitted to direct the destinies of this republic and to interpret its purpose to the remainder of the world, but in the fullest sense in the public interest. Duty to yourself should be satisfied with nothing less than maximum endeavor in Secretary Hoover's behalf.

Six Baskets Are Better Than One—or Two

NO ARGUMENT is necessary to establish the soundness of the precept about not putting all of one's eggs into the same basket. No individual, community or group of communities, state, or country should, with any claim to prudence, depend for its prosperity on the production of a single commodity. The Southern farmer who used to rely on cotton as the sole source of income—and who suffered grievously when the crop was small or the market unsatisfactory—has learned to raise tobacco and corn, hogs and dairy products, peaches and dewberries, in quantity sufficient to supply more than family needs. Today one or even two of his crops may be destroyed, or the price may sink to an unprofitable level, without threatening bankruptcy. The time was when a period of severe depression in the textile industry of New England resulted in serious economic consequences to the entire group of states. Although textile activity today is fully 15 per cent under that of a year ago, the slack has been taken up by other industries to such an extent that the net scale of industrial operations is virtually the same.

Diversity of manufacture in the United States as a whole is one of the basic reasons for the continued high rate of general industrial activity, despite several weak spots. An immense advantage is enjoyed over many other countries that depend almost entirely on one or two natural resources or classes of manufacture for their economic welfare.

The metal-mining industry has not been unmindful of the advantages of diversification; but the lesson may be repeated with profit for the benefit of companies that have not taken full advantage of it. Indeed, it applies with added force to a metal-mining company because of the fact that its officials should have in mind the perpetuation of its existence beyond the time when reserves in one mine may be exhausted. The company with available resources might to good advantage acquire mining properties situated in various regions, and particularly where metals other than those in the original mine are produced. Reliance on the market for a single metal may not in the instance of a particular company result in disaster, or even in financial hardship, if the mine be rich enough; but the wisdom of distributing the eggs in several baskets holds notwithstanding.

Each of the big smelting groups has reached out in various directions. Among those smaller companies that started as one-mine enterprises and that subsequently have become engaged in an important way in mining another metal or metals may be mentioned Howe Sound, Tonopah Mining, Calumet & Arizona, East Butte, St. Joseph Lead, and American Zinc, Lead & Smelting. A longer list could be made of those that have undertaken

exploration and development with this end in view but that as yet have not attained conspicuous or assured success. A few that come to mind are United Verde, North Star, Hollinger, United Verde Extension, Lucky Tiger, Nipissing, Bunker Hill & Sullivan, and Consolidated Mining & Smelting. The U. S. Smelting, Refining & Mining is a good example of a company that has widely diversified interests: gold in Alaska, silver in Pachuca, Mexico; copper in California—until recently; lead, zinc, and silver in Utah, Colorado, and Idaho; iron and copper in Colorado; and coal in Utah.

One would not advise a prosperous copper-mining company in Arizona, for the sake of diversification, to start raising wheat in Manitoba, or even making portland cement in Pennsylvania; but a promising gold-silver mine in Newfoundland, for instance, or an equally attractive lead-zinc mine in Peru, should deserve the serious attention of the directors.

A Plea for International Co-operation in Technical Advance

EUROPEAN visitors are struck by the freedom of access to American mining and metallurgical plants and the lack of secrecy regarding technical operations. With a few exceptions, notably among the zinc companies, and some others that are carrying on highly specialized work, or enjoying virtual monopolies, the technical visitor is welcomed everywhere, shown freely over the works, and freely informed on any details of operation in which he may be interested. Even costs are not withheld.

The editor of a mining journal is received, in a similarly frank fashion, even when it is known that data secured thus may be published. With the editor, however, an occasional objection is offered by legal advisers, who sometimes feel that publication of too many details may furnish ammunition to be used against the company in litigation. This, however, is unusual, and a matter that the operator thinks of last.

The American engineer, though he may have an occasional unfortunate experience, nevertheless has ample justification for believing, first, that he can learn something valuable from the visitor as well as disclosing his own experiences and practices; second, that when he, in turn, wishes to see what his contemporary is doing, his courtesy will be returned in kind; and, third, that even though his visitor receives more than he gives, no harm will be done to any one and at least one party will be benefited.

Elsewhere, however, little progress can be reported in the direction of that frank co-operation among technicians and engineers such as is in evidence in the United States. An Englishman who was requested recently to obtain information about some technical operations writes that unfortunately he is hampered "by the British habit of throwing a smoke-screen around all activities. An Englishman never stops to think," he says, "why he should, but always why he should not give out information. If he thinks he may be criticized for not selecting different equipment than he did, he will maintain a stony silence." This statement confirms the impressions gained by American engineers as a result of excursions abroad. Is it not time for the directors and managers of mining companies who are prejudiced against the free interchange of technical information to do a little introspective thinking? Numerous commissions have visited America in the last few years to study methods and to determine the reasons for this country's prosperity. Few, however, seem to have realized that the freedom of technical intercourse, for instance, is one of the chief reasons why the United States, even with high wages, produces 55 per cent of the world's copper, 40 per cent of its zinc, and 36 per cent of its lead; and why American engineers are in such demand in other countries of the world.

A Great Scheme— If It Works

THE American Society of Geophysics, which, according to its letterhead, is the "U. S. Branch" of something presumably far higher in the realms of erudition, the "International Society for the Advancement of Geophysics," was given some free, though perhaps unappreciated, publicity in an editorial in these columns on March 17. At that time it was mentioned that *E.&M.J.* had been offered an honorary membership, and had even been requested to submit advertising rates, so that the society could favor us with a small advertisement that it was hoped could come within its "limited budget." But apparently the business end of this self-styled society is not asleep, and it has now proceeded to the point of asking for advertisements as well as granting them.

The American Society of Geophysics is to publish "The Geophysical Prospector," in no less than four languages, and will give to manufacturers of geophysical equipment "the freedom of its editorial columns . . . free of charge, of course." In return for this kind favor, however, it is suggested that the manufacturer might advertise in the publication, at the rate of $100 per page or more. If the manufacturer wants to be right up among the highbrows of geophysical research he can also join the society, at a price not stated, and thus be privileged to put at the bottom of his ad: "Member of the American Society of Geophysics." This, it is presumed, will dispel any doubts as to the manufacturer's character on the part of the farmer who reads his announcement.

Farmer, did we say? Certainly the magazine will be read by farmers. Why, bless your heart, there are not enough geophysical prospectors in the world to support such an ambitious enterprise as this in the style in which it hopes to become accustomed. The publication will not only "endeavor to reach every mining and oil company in the world as well as every mining engineer and geologist of importance," but "the general public will also be strongly represented in the rank and file of our readers, and from inquiries in our possession, the percentage of farm and land owners in geologically hopeful districts, expecting to find subterranean riches beneath their ground by geophysical methods, will constitute a large part of our total circulation," according to what appeared to be a circular letter.

Among the announced public benefactions of this society, according to its secretary, whose signature looks like "Dr. Oscardeutsel," is a series of free lectures before "about 500 mining executives, engineers, geologists, etc.," the "etc." evidently including the farmers and land owners. These lectures are to be held, it is stated, at the University of California (Extension Building), in San Francisco. At this lecture, slides will be thrown on the screen reproducing the advertisements of geophys-

ical equipment manufacturers, the service of showing the slide being "free." That is, free, provided the manufacturer becomes "a member of The American Society of Geophysics as well as an advertiser in 'The Geophysical Prospector.'"

Previous publicity featured the connection of the so-called American Society of Geophysics with "Lincoln University, Phelan Building, San Francisco." The seat of propaganda has moved or has been moved to 1567 Russ Building, and the letterhead of the concern now indicates that "Lincoln University" is no more. In the meantime a publication designated "Underground," evidently sponsored by the same group, has appeared and disappeared. The latest move of the "Society" is seen in the proposed issuance of "The Geophysical Prospector" and an inference that it is affiliated with the University of California.

A New *E. & M. J.* Index of Mining Activity

WITH THIS ISSUE *Engineering and Mining Journal* introduces, as a new monthly feature, an Index of Productive Activity in Metal Mining in the United States. See page 1075. It takes the place of the barometer based on the consumption of electrical energy on the page of charts entitled "Indicators of Industrial Activity" that has been published for the last fifteen months. Experience reveals some shortcomings in the electrical index; particularly because belated returns are likely to necessitate revisions of moment in the extension of the curve based on the data available at the time of publication.

The new index is a distinct improvement. It is calculated from figures of primary smelter production in the United States of copper, lead, zinc, and silver, compiled by the American Bureau of Metal Statistics. To each metal a factor has been assigned that takes into account the average grade of the ores from which it comes, and the relative complexity of the ore-dressing and metallurgical operations involved in producing refined metal. In other words, the attempt has been made to indicate—as the name of the index implies—the degree of activity, carefully weighted, of productive operations in mine, mill, smelter, and refinery.

The chart now reflects, in a general way, the number of men employed, the amount of machinery and equipment in active service, the quantity of supplies being consumed, and the amount of electric or other energy being used. One difficulty arises from the variation in the length of the months. Ideal results can be obtained neither by taking gross figures for a month, regardless of its length, nor by adjusting the figures for the number of days in the month. The latter plan seems more satisfactory, and has been adopted; but, as can be seen by study of the graph, it tends to magnify the fluctuations: that is, daily rates for short months are inclined to be abnormally high.

If the rearrangement of the calendar to divide the year into thirteen months of equal length is effected, the statisticians will be among those to give earnest thanks. However, the general trend is disclosed; the data are reliable and can be obtained promptly. The chart should prove of unusual interest alike to producers and consumers of metals.

Removing Obstacles to Physical and Mental Contentment

A JOINT PROBLEM—insurance and the cost of sickness—is among the perennial subjects that cry aloud for attention. The *Saturday Evening Post* in a recent editorial hinted the possibility of state insurance and more governmental concern in the health of the Nation. This influential publication believes that "most industries, and perhaps even a high-minded profession like medicine, needs a little threat, a ghost on the back stairs now and then, to stir them into the highest measure of service. Institutions, like men, sometimes do their best work when another candidate for the job is waiting to step into their shoes." A governmental investigation into the cost and efficiency of life insurance might result disastrously, however. Lobby efforts in opposition would doubtless be made at Washington and elsewhere, the cost of which would be heavy. And the policy-holders, present and prospective, would have to pay—in premiums "loaded" with still further charges.

One can make provision against monetary loss from accident, but not against unemployment. Ample facilities are available to permit one to make finanical provision for one's heirs; but it is not so easy to obtain adequate protection against survival in combination with the major disturbing factor in life—sickness. So-called life insurance is usually death insurance, and the wisdom of pension schemes needs a much broader recognition than it has been accorded hitherto.

The findings of a committee on the High Cost of Medical Care, under the chairmanship of Dr. Ray Lyman Wilbur, president of Stanford University, is expected to deflect considerable public attention in the direction of a problem that often attains the proportion of a menace to solvency and causes perpetual worry among a large section of the population. When this condition is aggravated by crude propaganda aimed to drive all and sundry to the medical examiner's office, a factor of psychological suggestion is introduced that complicates a situation that is bad enough as it is.

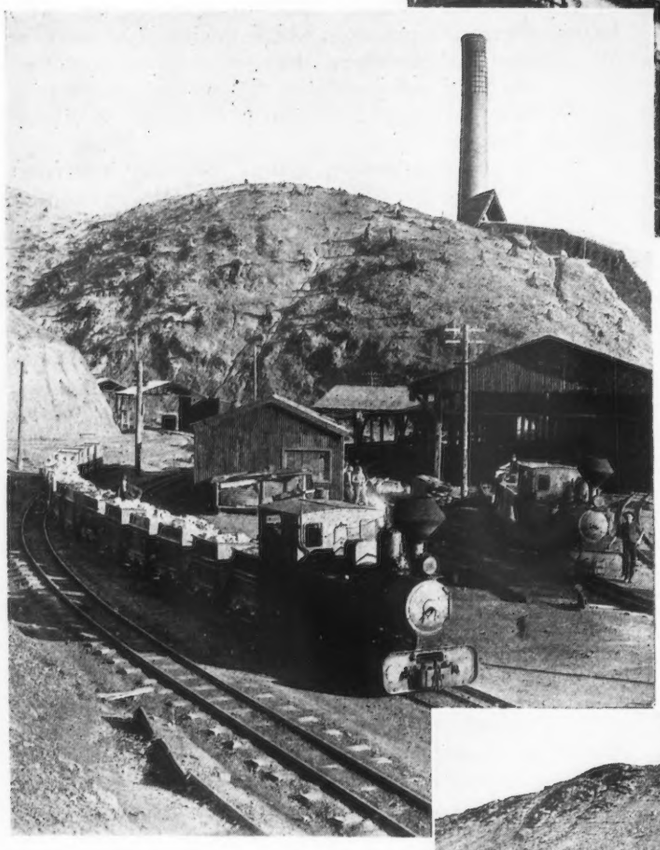
Gross incompetency among medical practitioners, especially in regard to diagnosis, is not uncommon. The cost of a surgical operation often proves a serious burden to the millions comprising the great middle classes, who are usually obliged to accept the verdict of one surgeon. Hospital charges are invariably excessive. Only the rich are free from anxiety as to ability to pay; the poor can avail themselves of free service at the many institutions that are available.

Industry has stepped into the breach to a commendable extent, showing that medical care can be dispensed efficiently and economically. It is good business for a company to keep its employees healthy and happy. Paternalism of this kind is one of the best evidences of recognition of a growing spirit of humanitarianism that might well seep into the broader channels of national life. More clinics are needed where the middle classes can get good medical service at a price which they can afford to pay; and more health insurance is a necessity for all but the independently well-to-do.

If one could adopt the Chinese practice of paying the doctor only when well, there would be fewer quacks, "qualified" and unqualified, registered and unregistered, and a larger number of useful people with sound minds in sound bodies.

Mount Lyell—A Veteran Tasmanian Copper Producer

To the right is shown the railway terminus and wharves at Regatta Point. Below is an ore train at the smelter bins.



The Mount Lyell Mining & Railway Company, Ltd., has been smelting its chalcopyrite and pyrite ores since 1896, recent production being at the rate of about 6,000 long tons a year. Flotation concentrate is sintered and smelted in blast furnaces and converters. An electrolytic refinery is being built by A. E. Wheeler, a New York engineer.

The North Mount Lyell mine, showing surface workings and the Crown Lyell shaft.

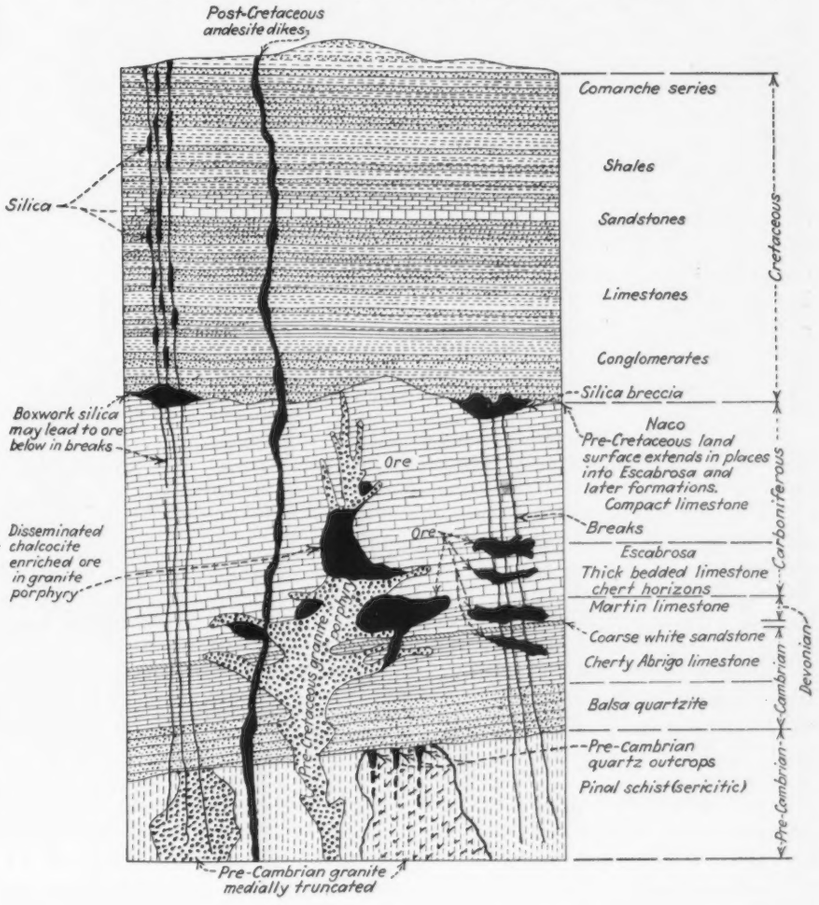
The Silica Outcrops
OF THE
Warren Mining District, Arizona

By Carl Trischka
Chief Geologist, Phelps Dodge Corporation, Copper Queen Branch Bisbee, Ariz.

BISBEE is situated in the Warren mining district of Arizona, and a great deal has been written about its mines and the geology of the ore deposits, but very little has been said about the silica outcrops, although they are prominent and of interest and importance. Ideal geologic sections have been made, but since their production, additional information has been accumulating, and the section herewith given and referred to contains these new data. (Fig. 1.) There are many widely dispersed areas of silica outcrops throughout the district, and they must have impressed the locators of claims as being important, because many claims have been located lengthwise of these various veinlike outcrop types. Where the silica has come up along strong breaks, in formations that were easily replaceable, it is veinlike in its rugged continuity along the surface. This type is often as much as 30 ft. high and 40 ft. or more wide. Where the breaks are not so strong or mineralization was less vigorous, and where the material was less replaceable, patches of irregular size and outline were produced, which have a veinlike appearance because the silica patches are close together and located along the breaks. Some of the silica is dense, fine-grained, and red, reddish, or black in color, due to contemporaneous iron or manganese oxides; and some of it is of a yellowish or pinkish colored boxwood structure, the openings of which are often incrusted with opaque quartz crystals. The whole outcrop contains practically no iron minerals. The outcrops are of hypergene origin, and for this reason their study is of economic importance, because they raise the question as to whether or not they may be guides to ore. Also, similar outcrops in other camps may be of sufficient importance to be investigated to find the ore that is likely to be associated with them. The important considerations are whether the outcrops are close to ore and whether the ore is directly below or to one side. It is a well-known fact that silica of hypergene origin often travels far from its source, or the sulphides it came with, before being deposited. Experience has shown this to be true in Bisbee; nevertheless, one kind of silica is a guide to ore, in that a strong surface outcrop indicates vigorous mineralization and the formation of considerable ore in its neighborhood.

A close study based on physical appearances has shown that there are two distinct types of silica outcrops and that they were deposited at different periods and under different conditions. In places the later type invades the earlier. One of the types, because of its appearance, is

Fig. 1—Generalized geologic section, Warren mining district, Bisbee, Ariz., as revised by Carl Trischka



called "Silica Breccia" and is of Pre-Cretaceous age, because it does not anywhere penetrate the Cretaceous formations. The other type is called "Boxwood Silica" and is Cretaceous or possibly Post-Cretaceous in age,

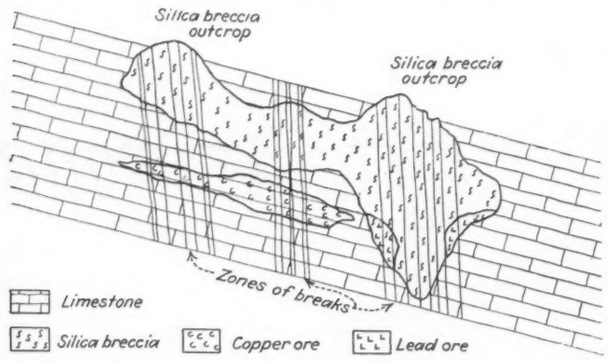


Fig. 2—Ideal section, showing relationships of breaks, silica breccia, and ores

because it is found penetrating the Cretaceous formation in many places.

Silica Breccia is a term applied to the siliceous, irony, and sometimes manganiferous, brecciated silica outcrops.

The Warren mining district, in common with most other extensively mineralized areas, was block-faulted and broken up to a considerable extent before the introduction of mineralizing or ore-bearing solutions. At Sacramento Hill the porphyry plug came up in Pre-Cretaceous times and shattered the limestones in a manner that produced a surface pattern similar to that which is produced when a bullet pierces a pane of glass. Here the breaks radiate from the hill and are concentric with it, on the south, or downthrow side of the Dividend fault. The ground was greatly broken up and crushed, being thus well prepared to be the host of the invading mineralizing solutions which soon followed.

At Bisbee the silica breccia occurs almost entirely in the Carboniferous limestones of the district. The brittleness of these limestones is marked, and this, together with various chert horizons, accounts for the angularity of the fragments of the breccia as well as for the few synclines and anticlines to be found here. Those that are present are mostly very gentle. The extensive faulting indicates that the rocks preferred breaking to bending. The chert horizons aided the breaking of the limestones in resisting bending. Block faulting, thrust faulting, and slip faulting of variable displacements, as well as sheeting zones, are common, and practically all of the faulting is in wide zones, so that it is usually difficult to designate any particular break in a zone as the one that is the fault. Faulting or sheeting zones 30 to 100 or more feet wide are common. The silica breccia outcrops are often connected underground by silica breccia which has formed along bedding slip faults or where the chert of the limestones, in breaking, splintered and prepared the ground for silicification. The surface outcrops fail often to show adequately the great extent of the silica breccia. (See Fig. 2.) Certain limestone beds seem to have shattered more readily than others; hence their silicification is more common. The fact that these beds often are in cherty horizons of the limestone may account for this.

Two fundamental things, as far as the silica breccia is concerned, happened when all of this breaking, faulting, and sheeting took place. First was the formation of cracks or other openings parallel to each other into which limestone fragments fell and were crushed by the movements of the walls of the cracks or openings against each other. The fragments were crushed as in a crusher. The resulting fragments vary in size between wide limits and are angular—seldom rounded. (See Fig. 3, I to IX.) Second, during the crushing action variable amounts of fine material or powder were produced which filled up the interstices between the fragments, creating a matrix for the fragments. Pressure of the surrounding rocks consolidated these fragments and matrix into a concrete-like mass within the break zones, the matrix resembling the sand and cement, and the fragments the rocks. During the process of consolidation, further minor cracking of the fragments took place.

As a result of fault movements, some of the layers of limestone were pushed apart as are the leaves of a book when its edges are rubbed by the fingers. Cracks and openings along bedding planes were formed, as well as brecciation of the limestone. The break zones and openings thus formed acted as further passages for the later invading solutions, and, like all of the breaking spoken of previously herein, created the first stage of silica breccia—namely, "lime breccia." It also accounts for the great variety of types. "Lime breccia" varies in character from the very large fragments of limestone having a thin network of connecting breaks which surround the fragments with minor amounts of fines or pulverized limestone, to very small fragments in large areas of pulverized limestone. The pulverized rock or matrix originally was compressed, but, as downward percolating solutions got to it, it was crystallized to calcite, often

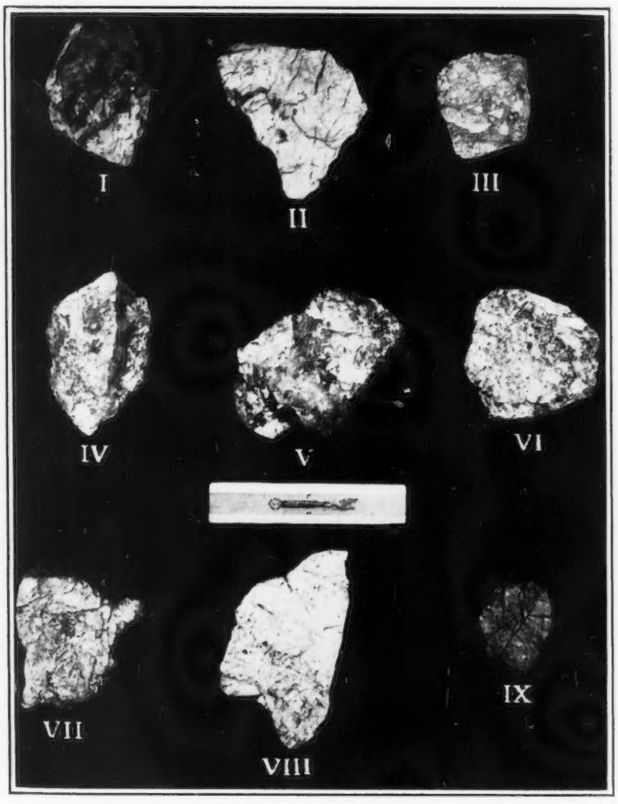


Fig. 3—Breccia types: I, II, and III are limestone breccia; IV is limestone-chert breccia; V and VI are limestone-chert silica breccia; and VII, VIII, and IX are silicified limestone breccia (silica breccia)

stained red by iron. Fig. 3, I, II, and III, shows this type of material, and although pictures the rock reduced in size, the pattern would apply equally well to areas 100 ft. or more square. Such material is common on the edges of silica breccia zones or outcrops, and its study leads to the comprehension of the formation of the silica breccia, which has for a long time been a subject of discussion.

Other types of unaltered or unmineralized breccia are found which have their duplication in silica breccia. In the type in which chert was present, the chert also splintered and broke into fragments, and we have lime-chert breccia. (Fig. 3, IV.) Here, fragments of chert and limestone are surrounded by crushed limestone and minute fragments of chert.

Such physical conditions as aggregates of rock fragments, pulverized rock, stresses and strains in break zones, and rock openings, all of which were present, are especially favorable to the passage of solutions and mineralization, and if the solutions are siliceous and the broken rock is limestone, silicification or replacement of the limestone fragments and matrix is readily accomplished. If hematite was present in the mineralizing solution, the matrix became dark red; fragments of limestone that were silicified became an opaque creamy white color. The chert fragments, being of silica, remain unchanged, and there results such material as VI in Fig. 3. Figs. VIII and IX show lime breccia silicification where no hematite was present.

It is more than likely that some of the beautiful lime breccias that are quarried for building stone have the same origin as the lime breccias here described, but conditions permitted a more intimate and consolidating growth with the result that they can be quarried. In the Warren mining district, also, a great deal of faulting subsequent to the formations of the breccias took place, opening old breaks and cracking not only the lime breccia but the silica breccia as well; otherwise the lime breccia could be quarried for building stone.

Replacement of limestone which was only slightly broken, such as the breaking that takes place along bedding slip faults, created a silica breccia which is 95 per cent fragments and has only small cracks that were once fine material or dust, but are now a siliceous vein-like matrix for the silicified fragments, making a more solid looking breccia in which the thin vein-like silica is not so readily seen unless the silicifying solutions contained hematite.

The breccia occurs as lime or silica breccia in faulted zones along single, narrow breaks distinctly showing the silicification of the fault gouge, which was made of broken fragments and fines. Silica replacement of individual beds of limestone that were broken up take on the characteristic shapes of replacement orebodies in miniature. The feeder break is silicified, as is the limestone bed for some distance each side of the break. (See Fig. 4.) In a wide silica breccia zone or outcrop the silicification is usually most intense at its center and grades out to lime breccia or lime-chert breccia at the edges. Underground, the conditions described are not so readily recognized, because their relationship is not so clear as on the surface but, having an understanding of the surface conditions, their underground modifications are clear and easily recognized.

Many of the fragments of silicified limestone contain fossils, and the arrangement of crinoid stems that were loosened by the crushing action is often along and around fragments of limestone. Chert but seldom contains any fossil fragments, so that fossils in a silicified rock can be assumed to indicate that the rock was originally a limestone.

A marked feature of practically all of the mineralization in the limestone area of the district is its abruptness. Excellent grade ore comes to a sudden stop next to comparatively fresh limestone, a thin $\frac{1}{8}$-in. selvage of gouge material often being all that separates the ore from the limestone. Limestone and silica breccia behave similarly.

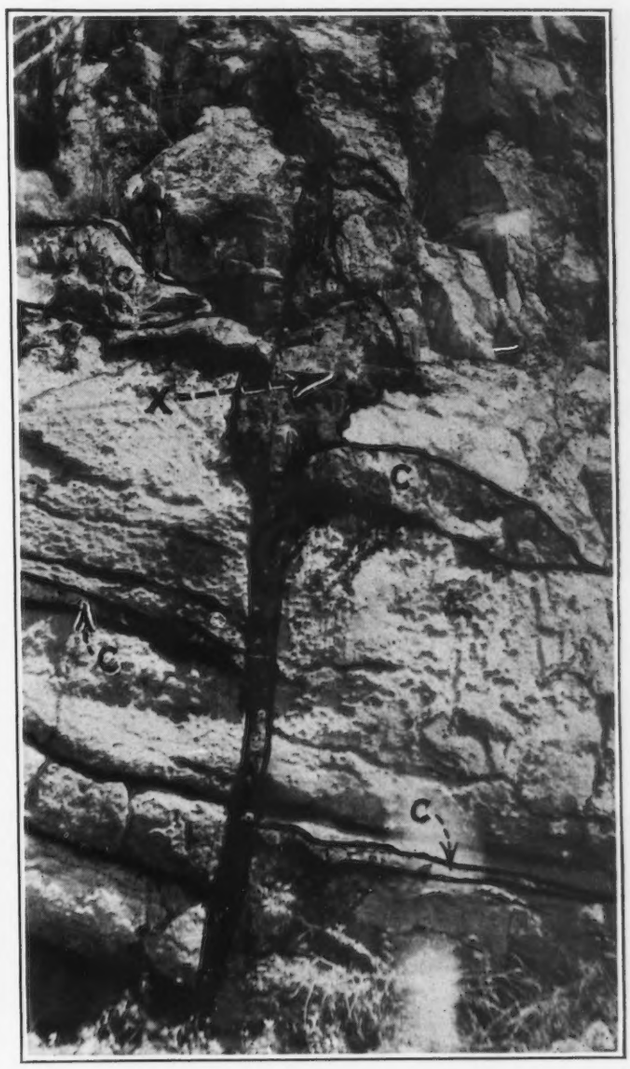


Fig. 4—Vein on fault in limestone. Replacement deposit in miniature

X shows replacement of limestone by hematite and silica; C indicates chert fragments and silicified limestone cemented by silica-hematite.

Granite porphyry, fresh and of the "dry" intrusion type is found in sills and dikes contacting with limestone that shows, as a change due to this contact, no more than slight marbleization. Contact metamorphic minerals are practically absent in the limestone areas.

According to Lindgren, the fragments of the breccia would be more rounded if the mineralization had been rapid, because there would have been a tendency for the fragments to go into solution rather than to be replaced. A vuggy cellular open structure would also have re-

sulted, whereas the silica breccia, except for subsequent faulting along old zones of weaknesses, is very tight and compact. Thus, replacement of the limestone by silica without solution was the form of mineralization.

Conclusions About Silica Breccia Outcrops

Silica breccia was first a limestone breccia which was produced by the crusher-like action of faulting or sheeting movements. A matrix of fine limestone powder and small fragments formed around the larger fragments. When mineralizing solutions came into the lime breccia they found ground prepared for their passage and ready for replacement. The resulting silica breccia shows this.

The following gradational types of breccia are found:

1. Limestone breccia.
2. Limestone-chert breccia.
3. Silica breccia with undigested or unsilicified fragments of limestone.
4. Completely silicified limestone breccia.
5. Limestone chert breccia with unsilicified fragments of limestone.
6. Completely silicified limestone chert breccia.

The fragments of limestone and chert as preserved in the silica breccia are mostly angular and not rounded, because the limestone was replaced and not taken into solution along its edges, which might easily cause rounded fragments. The structure of the replaced limestone is easily recognized in its silicified form.

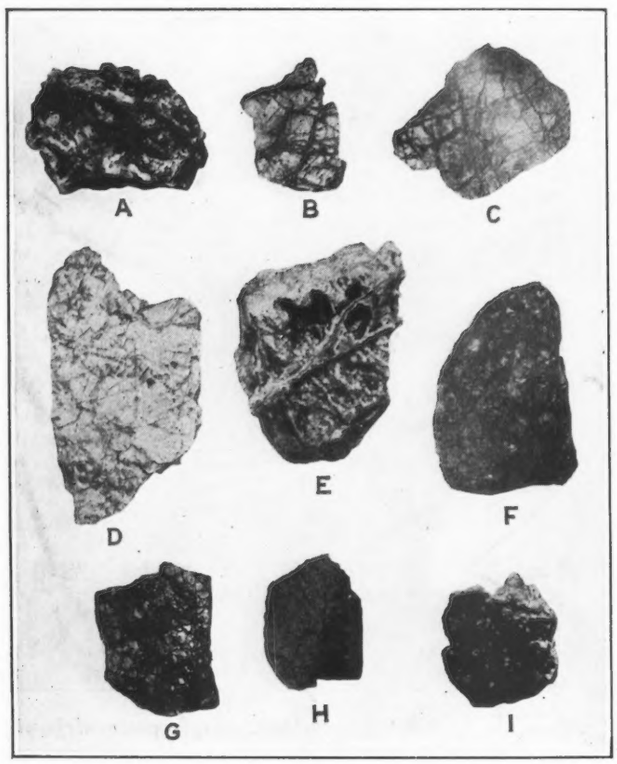


Fig. 5—Boxwork silica is shown in A, E, and I; silica breccia or silicified limestone breccia in B, C, and D; limestone breccia in F; silicified limestone chert breccia (silica breccia) in G; and silicified limestone breccia (silica breccia) in H

Silica breccia, in its lower underground portion, contained originally, in places, lead, zinc, copper, and iron sulphides in variable proportions. When oxidation of these sulphides took place a breccia skeleton resulted, from which most of the zinc, copper, and some iron were removed. The remaining silica skeleton containing lead carbonates and iron oxides was crushed owing to the weight of the overlying formations, and a fine-grained sandy material was formed which is mined as lead ore. In some places it is high in silica and in others high in iron. Glance and galena, as well as frequent showings of carbonate and silicate of copper, are found associated with the silica breccia in many places.

The underside of large areas of silica breccia is composed of primary hematite, which has grown into the breccia in many places. Also, manganese minerals replacing the limestone are found closely associated with the silica breccia in quantities large enough to be mined.

The silica breccia is not a certain guide to ore, because silica travels relatively much further than the copper sulphides, which are the ores sought, and the distances between the silica outcrops and the ore are exceedingly variable. Because of its erratic behavior it is not a good guide, as it does not point vertically downward, but abruptly changes its course, confusing the indicated relation and direction it bears to the ore. As a general guide it is useful, as it definitely indicates that ore mineralization has taken place, and the size of its outcrops can be taken as an index of the intensity of mineralization and the importance of the possible copper mineralization.

The thought that Spurr's veindike theory might explain the silica breccia of the Warren district led to this investigation and to the results herewith given. This theory was not found applicable, but it is not too much to say that Spurr's hypothesis is one of the most thought-provoking conceptions advanced in geology for many a day, and that the author of it advanced it to produce in geologists and others a desire not only to be satisfied in merely naming a thing, but also to explain it.

Boxwork Silica

During Post-Cretaceous times, intense faulting took place, and it is along these fault-zones that boxwork silica is found. Boxwork silica is an excellent guide to the Pre-Cretaceous land surface, because it is found most abundantly: on it where it has replaced limestone conglomerate; just below it in the Carboniferous or later limestones; or in the Cretaceous formations themselves a short distance above the Pre-Cretaceous surface. There are exceptions where the silica has penetrated, veinlike, to considerable heights in the Cretaceous formations, but it is not found at any great depth below the old Pre-Cretaceous land surface. It is distinguishable from silica breccia by its open structure, by being made up partly of silicified, rounded, detrital limestone boulders which, during silicification, sometimes were partly taken into solution and partly replaced, creating an open structure. Where replacement and silicification were incomplete, undigested limestone boulders remain.

In replacing the glance conglomerate in which schist, silica breccia, quartzite, chert, limestone, granite, and granite porphyry boulders occur, silicification is often most incomplete, and undigested fragments of the less replaceable or soluble parts are common. Where the silica breccia of the glance conglomerate contained manganese, the resulting boxwood silica in very exceptional places has the appearance of a silica breccia outcrop in the Cretaceous formation, giving rise to the erroneous belief that the ore mineralization under all silica breccia outcrops is Post-Cretaceous. During weathering, the unsilicified fragments are often taken into solution, and this is an additional cause of the open structure of box-

work silica. Where the conglomerate was greatly broken up by faulting, and the hot solution had many open channels to move in, and therefore was able to travel fast, solution of the fragments was almost complete, and the silica formed in the typical boxwork struc-

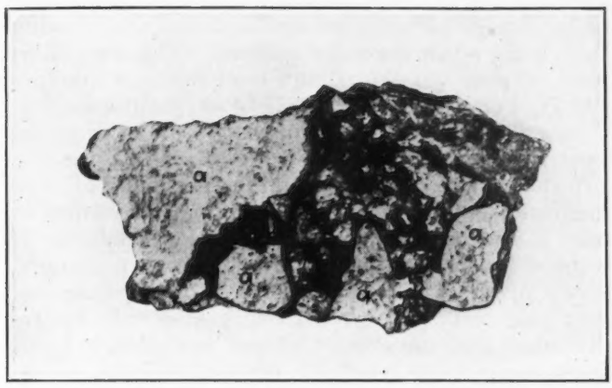


Fig. 6—A result of solution and replacement (in part) of andesite breccia by galena: "a" is andesite; black areas galena

ture such as A, E, and I, Fig. 5. Silicified limestone bars in which the fossils of the limestone have also been replaced often act as the braces of which the boxwork is built and on which the quartz crystals are frequently deposited.

The color of boxwork silica is mostly cream, light yellow, or reddish yellow. It is red or reddish only where the matrix of the replaced conglomerate contained iron oxides. Pyrite or other sulphide casts are not common and are found most frequently in the vein type. In such occurrences also, the reddish or yellowish color is somewhat increased by oxidation of the pyrite. Pyrite or other sulphides are found but infrequently.

Boxwork silica lacks any direct evidence of having been associated with minerals in amounts of economic importance. It is barren looking and its precious-metal content, except in occasional places, is low, or negligible. Also, in point of relative sizes of outcropping areas, it is smaller than silica breccia, although it is more widely distributed. It does not have the appearance of "bull quartz," but is distinctly a product of rapidly moving hot ascending solutions which have partially dissolved and partly replaced limestones and limy material, with the result that an open structure was frequently produced. The solutions did their best work of silicification in conglomerates, both limestone and glance conglomerate. Boxwood silica has penetrated the silica breccia in numerous places; also the glance conglomerate and Morita formations, both of Cretaceous age. It is thus different in type, age, and relation to ore from silica breccia, but like it in that it is the product of replacement processes which were of a similar kind but different in degree.

From maps on which the silica outcrops are shown with relation to the various formations in which they are found, it is evident that where erosion has just reached the Pre-Cretaceous surface of the Carboniferous and earlier limestones, the silica outcrops are most numerous. An examination of these outcrops shows that they are practically all Cretaceous or Post-Cretaceous in age and of the boxwork silica or conglomerate silica type, as shown by the surrounding unsilicified limestone conglomerate. This limestone conglomerate is of Pre-Cretaceous times, and is probably made up of the limestone detrital material found on the slopes of the irregular hilly land surface which existed just before the basal Cretaceous glance conglomerate was laid down.

Boxwork Silica: (1) Is hypergene in origin, having come up in solution channels made in Post-Cretaceous times. (2) Is the result of replacement and solution of limestone, limestone conglomerate, glance conglomerate, and Morita sandstone where these formations are cut by breaks. (3) Is yellowish in color. (4) Has an open structure, the openings of which are frequently incrusted with quartz crystals. (5) Is an indirect guide to ore where it has come up along the older mineralized breaks or silica breccia on or near which Pre-Cretaceous ore was deposited. (6) Occurs mainly near the Pre-Cretaceous land surface. (7) Has not as yet been found to be a direct guide to ore, because it is not so intense or so large in individual areas as silica breccia mineralization. (8) Does not contain, except very rarely, any ore-forming sulphides or other minerals but contains at times some syngenetic pyrite in the replaced limestones.

General Conclusions

1. There are two major types of silica outcrops in the Warren district: silica breccia and boxwork silica.

2. They are of two ages, respectively, Pre-Cretaceous and Post-Cretaceous.

Fig. 7—Illustrating first stage of brecciation. Bending and cracking of limestone and chert beds. Note that limestone bends whereas chert cracks. Chert is shown by c.

3. They are both replacements of broken limestones or other rocks but limestone breccia was replaced slowly by ascending solutions without being taken into solution forming silica breccia, a dense silica often mineralized with manganese or iron oxides, or copper minerals.

Further, limestone conglomerate or glance conglomerate was replaced more rapidly by hot ascending solutions and was taken into solution as well, usually forming an open structure, called boxwork silica, in which the character of the replaced limestone boulders is often discernible.

4. They are both hypergene in origin.

5. Silica breccia was directly associated with commercial quantities of ore and can be used as a guide to ore mineralization, though it is often a great distance from it. Boxwork silica has not as yet been proved to be so associated, nor does its character indicate the likelihood of its being so. It may be used as an indirect guide to possible Pre-Cretaceous ore. A little study readily enables one to distinguish between them.

Pre-Cambrian Quartz Outcrops

One other quartz outcrop deserves mention in connection with the foregoing discussion. It is not of any economic importance, and hence is not given the prominence of the other two types. It is found on the western border of the small-scale map of Dr. Ransom's U. S. Geological Survey folio of the Warren mining district, in Juniper Flat granite, and consists of quartz veins that pinch and swell along their length. In the quartz, occasional high-grade gold ore is found, but taken altogether the veins are neither continuous enough, nor is the grade high enough, to make mining profitable. A few shafts sunk in the veins have found several small kidneys of sulphides of iron, copper, zinc, and lead, but their tenor and size were insufficient to encourage efforts to look for others. The quartz is of the milky white "bull quartz" type, and fluorite is associated with it in many places. It is in the Juniper Flat granite (Pre-Cambrian) stock, which has been medially truncated. The veins are irregular in their bearings and sizes, and because of their position in the stock economically unimportant.

Thus there have been three known periods of silica mineralization at widely distributed times, and each has been accompanied or preceded by igneous activity.

Difficulties of Mining 1⅛ Miles Underground

THE difficult conditions attending the conduct of mining operations at the depth reached by the Village Deep mine, on the Rand, were emphasized by the chairman at a recent meeting in Johannesburg. During 1927 the average depth at which stoping operations proceeded was 6,089 ft., or rather more than 1⅛ miles, vertically below the collar of No. 3 shaft. For the first quarter of 1928 the average depth was 6,295 ft. Development operations are now being carried on at a vertical depth of 7,200 ft., and the lowest point reached in the west subincline shaft is 7,300 ft. below the surface.

Very efficient ventilation has been secured from the large fan, installed in December, 1926, which has a capacity of 370,000 cu.ft. of air per minute, and subsidiary arrangements for distribution of the air have been made so as to obtain the maximum benefit from this supply. The development faces are, in the circumstances, remarkably well ventilated; the supply and distribution of fresh air in the stopes are more difficult to control, and the effect of the high rock temperature on the atmosphere in the stopes is consequently greater.

In consequence of the deep level conditions an ever-increasing proportion of the available native labor force is required for non-productive work, such as support of mine workings and other safety measures. All underground natives, upon engagement, are first given a spell of light work, until they are sufficiently accustomed to the underground conditions to permit of their being fully employed. These considerations materially restrict the productive output per unit, and during 1927 they added to the handicap imposed by the persistent shortage of native labor from which the mine suffered. The margin between revenue and expenditure is so small—it averaged only 7d. per ton milled in 1927—that the maintenance of an adequate native labor supply is of supreme importance.

In stoping operations at depth, the possibility of pressure bursts has always to be considered. In a number of cases it has been necessary to abandon remnants of blocks which have become subject to excessive pressure, in view of the risk of accident which would be incurred by stoping them. The consulting engineer, in his report, states that the area at present being left for this reason amounts to about 10 per cent of the blocks. Sometimes these remnants, or portions of them, are recovered later by reclamation when the ground has settled, but this is not always possible.

Nipissing Produced Silver for 47.3c. per Ounce in 1927

NIPISSING Mining, operating in the Cobalt district of Canada, gives the following data on silver production costs for 1927:

	Per Ton Ore	Per Ounce Silver, Cents
Diamond drilling	$0.127	0.527
Exploration	1.463	6.094
Development	2.112	8.799
Stoping	2.176	9.068
Assaying and engineering	0.169	0.708
Residue and dumps	0.124	0.519
Administration and office	0.428	1.783
Camp maintenance	0.161	0.670
Insurance and taxes	0.474	1.977
General and legal	0.157	0.656
High-grade mill	0.528	2.201
Low-grade mill	3.056	12.732
Marketing product	0.114	0.477
Corporation, New York office, and traveling	0.255	1.062
Totals	$11.344	47.273
Less rent, exchange, and miscellaneous income	0.112	0.468
Balance	$11.232	46.805

A total of 1,890,269 oz. was produced from 78,767 tons of ore at a total operating cost of $884,737.

A New Tunnel-Driving Record

SO FAR as available records show, the Cia. Minera de Peñoles, American Metal Company subsidiary in Mexico, established a new world's record for rapid tunnel driving when it advanced the Ojuela adit an average of 714 ft. for seven consecutive months. For sustained speed in a single heading this record appears to be unequaled. In an early issue, three of the men who had direct charge of the project will describe the methods, the equipment, and the organization of the work, that made the excellent performance possible. Details of costs are a feature.

The Gasoline Engine as a Mining Power Unit

Deep-hole Prospecting Also a Feature at Memphis Property in New Mexico

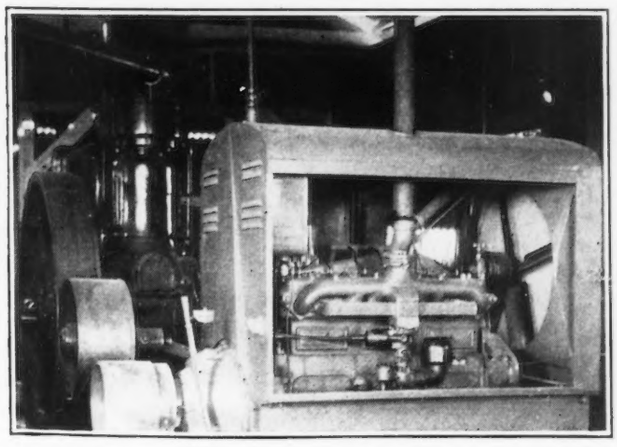
By T. M. Bains, Jr.
Colorado School of Mines, Golden, Colo.

WITHIN the last two months, the new installation of the Memphis Corporation at its property at Organ, N. M., has been completed, and several points of interest are connected therewith. This property has been worked by lessees and by a small mining company intermittently for many years. It has produced considerable copper-silver ore, with some high-grade oxidized zinc ore. Recently the property has been taken over by the Memphis Corporation, of Boston, and extensive development has been planned. The new installation has certainly increased development facilities.

Power is secured from gasoline engines, and the Sullivan angle-compound compressor is shown in Fig. 1, with its 100-hp. Buda engine. The hoist, shown in Fig. 2, is at present a single-drum type driven by a 34-hp. gasoline engine of the same make. The purpose was to allow development with a single-compartment hoisting shaft; later, the 100-hp. engine of the compressor unit will be placed on a double-drum hoist and an oil engine used to drive the compressor. Another 9-hp. hoist of similar type is being used at another shaft on the Memphis.

The old type of "hit-and-miss" slow-speed engine of the Goldfield days has been replaced by this type of high-speed automobile engine. Among the advantages gained is decrease in weight and foundation area, and a greater understanding of the equipment owing to the fact that almost every man of the crew now goes to work in an automobile and is familiar with the motors therein used.

Fig. 1—Gas-engine-driven compressor



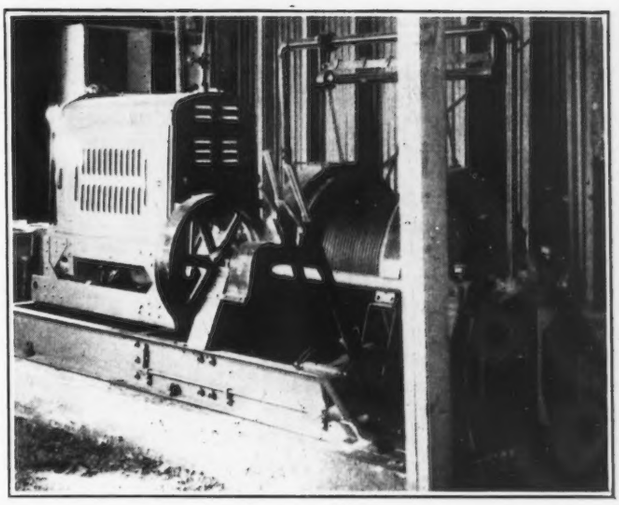


Fig. 2—A smaller engine, of similar type, drives the hoist

The new headframe has been designed for two hoisting compartments, although the shaft at present is but a single-compartment hoisting shaft. It is proposed to raise and make the second compartment later, and thus use the same headframe.

"Deep-hole" prospecting equipment for prospecting with compressed air machines has been used successfully at the larger mines like the United Verde, Cananea, Anaconda, and New Jersey Zinc at Gilman, Colo. Anaconda's practice of "stelliting" the bits will be practiced here. The stellite, an alloy of tungsten, cobalt and chromium, is extremely resistant to abrasive action and decreases the number of changes of bits for any certain depth of hole.

Where there are "water channels" in the limestone, as there are at Organ, the diamond bit can secure a core from the further side of the channel, but at the risk of tearing out the diamonds. One mine using the diamond bit in similar ground has had to stop its use owing to various troubles not met with in the "deep-hole" method. However, hitherto, the deep-hole prospecting has stopped at a water channel. This is being overcome at the Memphis by drilling a few inches into the further side of the channel wall, then introducing a piece of pipe to span the channel, wedging it by a special method, and then proceeding with a bit that will fit inside of this pipe. This decreases the size of the hole, but if the channel

is struck when the larger-gage bits are being used, the hole can probably be finished and the sludge sample secured.

The interesting geological feature of the Memphis property is that although the "contact" of diorite and Paleozoic sedimentary rocks has produced large orebodies in the Torpedo property adjoining Memphis on the south, still, this "contact" in all these years has never been prospected for copper-silver ore. Again, the Stephenson-Bennet property, still further south on the same "contact," was principally rich in silver, lead and molybdenum, whereas the Torpedo had strictly a copper-silver mineralization. The Memphis combines the two types, having rich silver-lead-zinc and silver-lead-bismuth oreshoots in the limestone, and copper-silver orebodies, similar to the Torpedo, along the "contact."

Molybdenum is indicated by the crystals of wulfenite occurring in the outcrops, with lead and silver ores. The most interesting mineralogical occurrence, however, is the enrichment of bismuth in various "shoots." This occurs in bunches assaying near the surface as high as 30 per cent bismuth and 300 oz. of silver. On the 200 level, assays have been secured that showed 210 oz. of silver and 10 per cent bismuth.

Some of the complex ores found have assayed from 25 to 43 per cent zinc, 10 to 15 per cent lead, 30 to 35 oz. of silver, and 3 to 8 per cent copper, practically being a sulphide ore requiring selective flotation to secure complete separations and recoveries. Ore of this type is being shipped now to the A.S.&R. smelter, which recently has been more lenient with the zinc penalty.

Officers of the company are residents of Boston. H. H. Hughes, Jr., formerly with the Cia. Minera de Peñoles, is superintendent in charge of operations. G. T. Harley, formerly with the Phelps Dodge Corporation, geologist and efficiency engineer, is also on the staff.

The Disposition of Explosives' Trash

WHEN consignments of explosives, or explosive devices, reach the mines, practice differs as to the methods employed in their distribution, states Dr. C. E. Munro, of the U. S. Bureau of Mines, in a recent National Safety Council bulletin. At some mines the packages, when their contents are needed for use, are opened in a specially provided and secure place outside the mine and apart from the magazines, and the cartridges of explosive, as well as the electric detonators, or detonators and fuse, are unpacked from their containers and issued to the miners or blasters, each to be placed in its separate, specially designated and approved receptacle in which it is to be taken into the mine. This is the best practice.

At some mines, however, the explosives and explosive devices are taken into the mine in the original containers as received from the shipper, where they are opened and the explosives and explosive devices distributed. As a consequence, there is left within the mine a lot of trash in the form of wooden boxes, cardboard cartons, sawdust, wrapping paper (some of it paraffined), all of them being inflammable and combustible. That from the packages of explosives is especially menacing because, at times, portions of the explosives may adhere.

A mine is an inclosed chamber in which the air may be readily fouled by the emanations from the men and beasts engaged in it; the combustion products from open-flame miners' lamps; the gases and vapors resulting from the firing of the blasts; the products of fermentation of wood and other organic substances in the presence of water, and those of putrefaction; and the natural gases from the rock and earth, so that to keep a mine in fit condition for men to labor in, it should be well ventilated.

When wood, sawdust, paper and similar substances are burned, they yield large volumes of irrespirable and poisonous gases, among them the very poisonous carbon monoxide. If any of the explosive be adherent to the trash there may be produced, in addition, on burning, the exceedingly poisonous nitrogen oxides, all of which would so quickly tend to foul a mine in which they are burned as greatly to tax the best of ventilation systems to render it habitable.

Hence safe practice demands that nothing should be burned in mines; that all explosives' trash should be promptly removed from mines; and that this trash should be burned outside the mine in a safe place.

Nipissing Milling Operations in 1927

A FEATURE of the annual report of the Nipissing Mining Company, Ltd., is the liberal use of statistical tables, with allocation of various charges. A few of the more interesting tables, giving mill data, are reprinted here.

Costs of Chemicals and Supplies at Low-Grade Mill

	Cost per Pound	Per Ton of Ore Milled: Pounds Consumed	Cost
Sodium cyanide	$0.1870	4.464	$0.835
Lime	0.0072	4.160	0.030
Pebbles	0.0110	3.463	0.038
Sodium sulphide	0.0423	0.754	0.032
Caustic soda	0.0392	0.351	0.014
Aluminum	0.2520	0.054	0.014
Hydrochloric acid	0.0283	0.110	0.003
Steam coal	0.0047	24.714	0.116
			$1.082

Based on 78,767 tons of ore milled in 1927 the following data are given for operations at Nipissing's low-grade mill:

	Tons	Assay	Ounces Contained
Ore treated	78,767	23.65	1,862,839
Recovered in products			
Precipitate	26	25,613	665,934
Coarse concentrate	572	1,860	1,063,692
Fine concentrate	110	531	58,422
Total recovery			1,788,048

Average tailing, 0.95 oz. Recovery 95.99 per cent.

Forty stamps ran 318 days, 9 hours, or 87.2 per cent of possible running time. They crushed 247.40 tons per day, or 6.19 tons per stamp per day.

Cost Data

	Total Cost	Cost per Ton
Crushing plant	$4,325	$0.055
Aerial tram	2,752	0.035
Surface tram	9,962	0.126
Crushing and elevating	16,793	0.213
Batteries	21,564	0.274
Tube mills and classifiers	28,977	0.368
Concentration	15,725	0.200
Cyanide treatment	88,963	1.129
Filtering and discharging	12,727	0.162
Clarifying and precipitation	13,222	0.168
Refining	6,073	0.077
Heating	14,784	0.188
Water service	2,887	0.037
Residue dam	1,118	0.014
Research	788	0.010
Totals	$240,678	$3.056

Cost per ton—Labor, $0.988; supplies, $1.407; power, $0.537; shops, $0.192; credits, $0.078; or a total of $3.056 per ton for crushing and extracting the silver from the ore.

Diamond Drilling

A Synopsis of Its Technic and Advantages

By Byron M. Mitchell
Cobalt, Ontario

DIAMOND DRILLING is a method of prospecting in which core samples are recovered. Generally its use is the first step in the development of mineral properties, and the evidence obtained not only proves the existence and extent of an orebody, but also its metallic content. The information obtained has, many times, confirmed or confuted the theories of engineers as to whether or not ore existed. If ore is thus proved, the company knows definitely how to begin mine development and where to sink shafts and drive tunnels with the maximum results and the minimum of expense. The diamond drill furnishes definite data on which a company can arrange its financing to advantage and allows the company to save large sums that otherwise might easily be lost in sinking non-producing shafts and drifts, by proving beforehand where the ore lies.

The diamond drill recovers a core by rotating hollow tubing under pressure against a rock surface. Fastened on the bottom of the tube is a bit, containing black diamonds, which acts as the drilling agent, abrading a cylindrical hole in the rock, from which a core is removed. The hollow tubes are known as rods. Water is forced through them to wash away the sludge at the bottom of the hole and to keep the bit cool. The rod to which the bit is attached is the core barrel; and when this tube becomes filled it is pulled out of the hole, bringing with it the core, which is caught and held within the barrel by a core lifter, or by a process known as blocking, achieved by shutting off the water supply flowing through the rods to the bit and running it dry. Mud accumulated at the bottom of the hole becomes compacted; and, acting as a cement, effectively seals the end of the bit and prevents the escape of the core as the rods are pulled. The rods, after the core has been removed, are lowered again, and the process is repeated until the desired depth is reached.

THAT part of the mechanism that creates the necessary pressure for the boring of the rock, the swivel head, can be pivoted or swiveled in any angle and is thus capable of drilling holes in any direction. The rods, screwed together in 10-ft. sections, are run through these gearings and fastened by means of a chuck. Rotation is secured by a bull wheel and drive shaft connecting with the source of power. The swivel head may be a piston operated by a hydraulic cylinder, or a screw feed, which produces downward feed pressure, according to the ratio of the gears used. Gears are numbered from 50 to 1,400, indicating the number of bit revolutions needed to bore one inch. The screw has three sets of gears, which can be shifted according to the nature of the rock. Gears of the low ratio are used for soft rock and a higher ratio for hard rock. The gears can be changed by removing a set of three from the screw feed of the apparatus.

The hydraulic feed consists of a water cylinder divided into two compartments, a hollow drive rod and a miter gear. The drill rods run through the drive rod and are held fast by a chuck attached to its base, the principle being the same as that used with the screw feed. Pressure is controlled, however, not by gears, as with the screw feed, but by admitting water into the upper compartment of the cylinder and permitting an equal amount to escape from the lower one. Theoretically, at least, the hydraulic yields a surer and steadier pressure than does the screw feed. Speed can be controlled according to the amount of water forced through the cylinder. Such a mechanism permits greater efficiency and accuracy by allowing the adjustment of pressure to the requirements of the formation drilled. When a bit on the end of a long line of rods becomes stuck in the drill hole, a forced shutdown is avoided. The flow of water can be reversed in the hydraulic cylinder, causing an upward pressure on the drill rods, which, unless they are unusually tight, are freed. [Some operators assert that the screw feed is more foolproof, and they have found it more efficient because they cannot get expert drillmen to handle a hydraulic feed.—Editor.]

BRAZIL is the only country in which carbon (the trade name for diamonds used in diamond drilling) is mined in commercial quantities. First-class "carbon" sells for $165 a carat. In 1888 it sold for $15 per carat. Within the last few years one-quarter and three-quarter carat stones have increased in value from $18 per carat to $70 per carat. This rapid appreciation in value would indicate that production has not kept pace with consumption. Carbons differ from white diamonds in that they are amorphous, non-crystalline, and possess no planes of cleavage. The smallest stones weigh about one-sixteenth of a carat. The largest one ever found weighed 3,078 carats. This was broken into comparatively small fragments, weighing from two to four carats, which is the average size.

Another important accessory of the diamond drill is the core barrel, which serves as the receptacle into which the core is received after being cut by the diamond bit, and within which it is retained until brought to the surface. Core barrels vary in length from 2 to 30 ft. but those most commonly used are 5 or 10 ft. long. They consist of two tubes, one within the other. The inner tube is prevented from revolving with the outer one by a ball-bearing attachment. Friction between the core and the inner barrel is reduced to a minimum, conducive to the saving of a maximum percentage of core. In the old barrels an inner tube was not employed, and besides the whittling away of the core by friction against it, the water

necessary to keep the hole clean and the bit cool gushed against the unprotected core and complete disintegration sometimes resulted. The double-tube barrel protects the core as far as possible; moreover, the water is prevented from coming in contact with the core by a divider, which causes it to flow between the inner and outer tube, making it impossible for water to touch the core until it is discharged close to the bit. An attachment just above the bit, called a swelled coupling, is slightly larger than the barrel itself. Small diamonds can be set in it to aid in maintaining the gage of the hole. Coupled to the top of the barrel is a corrugated jacket of steel known as a ferrule. It tends to prevent the vibration of the rods which breaks up the core. The ferrule at the upper end and the swelled coupling at the lower end of the core barrel brace it and aid in maintaining the bit in the line of its objective. It is claimed that such barrels are capable of coring mud.

AN ALMOST limitless diversity of work encountered by the diamond driller has made necessary the development of a great variety of machines. Drilling outfits range in size from small hand-driven drills to large steam- or air-powered machines capable of boring holes 7,000 ft. deep. They vary in weight from 300 to 20,000 lb. and produce cores from $\frac{3}{16}$ to 6 in. diameter. The intermediate types are powered electrically, or by gasoline, steam, air, or oil engine. Some are able to move about under their own power and are desirable when transportation facilities are poor. One of the most efficient of these is the "UG" machine (originally designed for underground work), built on skids and powered by a Ford Model "T" engine. By a system of sheaves and cables it hauls itself over bad country or up precipitous slopes to hole sites which ordinarily would require the building of roads to reach. The success of this machine has been such as to warrant the manufacture of larger and more powerful drills of the same pattern. Discontinuance of the manufacture of the Model "T" engine is no obstacle to the further production of the "UG" type of drill. Any light engine for which spare parts are available can be used with equal success.

ALTHOUGH not perfected commercially as yet, the newest and most remarkable diamond drill is the "turbinair," a machine incorporating the turbine motor and powered by steam or air. It is especially adapted for underground drilling. Other machines are manufactured with a view to meeting the specific requirements of the work to be undertaken, and designed so that they can be sectionalized if transportation facilities are poor, and packed on the backs of men or mules.

Diamond drilling is a highly specialized art, needing years of apprenticeship. Experience—actual participation in the work—is the essential factor. It cannot be learned in any other way. The drill operator is called a runner. He must remain constantly on the alert and know what his bit is doing. He relies almost entirely on his senses of hearing and sight. The least change in the sound of the machine indicates to him a change in the hole. If his machine has been running quietly, but suddenly sets up a clattering and noisy vibration, the runner knows he is drilling through broken rock. However, the same reaction may result from the vibration of rods in the hole, so the runner must be able to distinguish between the two. Speed is decreased where the formation is shattered or when vibration occurs, but the latter condition can be and in most cases is avoided, by the use of grease on the core barrel and rods. A runner's eyes must constantly watch the water-pressure gage, pressure indicators, return water, and the machine in general for any warning of a change in formation. This alertness is necessary to safeguard the diamond bit which the runner controls and for the information which the change may portend. The position of an open seam or cave can be determined by measuring the depth of the hole at the point where it is first, and last, encountered.

A DIAMOND drill hole is measured by counting the joints of rods in the hole and subtracting any part of the last one that projects above the collar. As the rods are in standardized lengths, distance is readily computed. A runner keeps a log in which is recorded the date, depth of hole at start and finish of shift, amount of core recovered, strata penetrated, and geological features of importance. A runner has one assistant or helper. The foreman of a diamond drill crew is known as a setter. He is responsible for the job and is generally one who has had considerable experience as a runner. Beside aiding his crew in times of trouble his chief duty is the setting of bits.

It is an art to set carbons so that they will present the most efficient drilling face, with protection against breakage and consequent loss, and greatest accuracy as to gage. This last factor is important. A hole cannot be started, for example, at $\frac{15}{16}$ in. in diameter and allowed to decrease in size as it gets deeper, which it will do as the bit wears. This tendency to pinch the hole as it is drilled is overcome by the setter keeping his bits set to the same scale. Usually eight stones are set in a bit; four on the outside and four on the inside. All are set so as to have drilling edges on the face of the bit, uniformly spaced.

Bits are of soft steel. After a carbon is selected a hole is drilled into the bit as nearly the size of the stone as practicable. Chisels are then used to shape the hole to conform to the shape of the diamond. After seating the diamond, special care is taken to pad the stone, and the metal of the bit is then calked around the stone. The stones are given a clearance of $\frac{1}{32}$ to $\frac{1}{64}$ in., depending on the nature of the rock. Great care must be exercised in calking in the diamonds, and in keeping them up to gage, so that each stone has the same amount of clearance. Diamonds will stand great bearing pressure, but are shattered by impact.

IN SPITE of the value of diamonds, the cost of diamond drilling is comparatively low. Drilling on the average can be done for from $2.50 to $7 per foot, depending on conditions. Factors that determine the drilling rates are the nature of the rock to be drilled; transportation facilities (proximity to highways or railroad); availability of water; amount of work to be done; character and nature of overburden; whether the work be started at the surface or underground; and the housing accommodations for the workmen.

The harder the rock the slower the progress will be. Broken ground and that which possesses a tendency to cave, decrease the speed of drilling, particularly if the hole requires casing. When such conditions are met, drilling will be more expensive. Transportation is a factor in determining the cost of a job; where roads are lacking they must be built, so that material can be teamed in to the site or packed in by the crew. When water is not available it must be hauled from some distant source,

which usually causes delays that cut down the effective drilling time of the crews. However, wages go on, and this results in higher costs. When accommodations for the crew are not available, an extra expense is involved in providing these facilities. A large aggregate footage will give a slightly reduced cost per foot. But if a job involves a limited footage, the same expenses are involved in the cost of shipping equipment, transporting the crew, and general expense, as with the big job, with the result that the shorter job necessarily costs more per foot. If a great amount of top material is to be penetrated before actual bedrock is encountered, the cost will be greater, for such work necessitates the handling of equipment not ordinarily required in diamond drilling.

STAND PIPING, necessary if overburden or alluvial is present, is accomplished by hammering heavy double-strength pipe into the ground. The earth forced up into the pipe as it is hammered downward is washed out by delivering water under pressure through another pipe inserted into the driven pipe. When boulders are struck, the drive pipe is driven hard down on them, the interior cleaned out down to the obstacle, and dynamite lowered within it. The drive is then pulled back about 3 or 4 ft., allowing the dirt at the bottom of the hole to flow back over the dynamite, thus giving some tamping and preventing injury to the lower end of the drive pipe. Where boulders of average size are met, one charge of from two to six sticks of dynamite is sufficient to shatter them so that the pipe can be driven through. Actual drilling takes place when bedrock is reached.

Diamond drilling is the ideal means for a close estimate of the cost of developing a mine. It can be done at a small cost by specialists of long experience in this work. Diamond-drilling organizations have efficient and advanced types of equipment, as well as trained operators and they can do the work quickly, cheaply, and expertly.

Aviation Aids Economic Development of Alaska

THE BIRTH of modern Alaska may be said to date from the Klondike gold discovery in 1896, says Emmett A. Chapman, division of regional information, U. S. Department of Commerce. Visions of gold lured thousands to its shores, and between 1880 and 1927 minerals valued at $571,000,000 were recovered, of which $360,300,000 was gold and $188,000,000 copper. The peak of mineral production was reached in 1916, when more than $48,000,000 worth was mined, but since that time production has fallen gradually to $17,658,000 in 1926. Attention in more recent years has been turned to salmon, the golden harvest of the waters.

The developments of aviation in the last few years are of particular importance to Alaska. Places in the territory accessible heretofore only by dogsled can now be reached quickly and comfortably by airplane, and Alaskans expect that within a few years tourists, naturalists, big-game hunters, and fishermen will find Alaska an ideal summer playground.

Realizing the great advantages to be gained by encouraging commercial aviation, the territorial legislature in 1925 authorized the Territorial Board of Road Commissioners to divert from the 1925 biennial road appropriations the sum of $40,000 for the construction of aviation fields; and as a result of this legislation 44 landing fields have been laid out at strategic points in the territory, varying in size from 300x800 ft. to 600x1,400 ft. At present at least three commercial aviation companies are operating a total of eight planes. They carry passengers and freight to hunting lodges, trappers' runs, to isolated villages, and to mines at remote points.

Asphalt Industry Showed Marked Gain Last Year

THE demand for good roads by the millions of motorists in the United States has proved a boon to the asphalt industry. Asphalt finds its chief use in paving, and, though subject to keen competition from both concrete and coal tars, its consumption has increased. This is reflected in the statistics of the industry covering the year 1927 as compiled by G. R. Hopkins of the U. S. Bureau of Mines, which record total sales of asphalt and asphaltic materials manufactured from petroleum of 3,951,450 tons, an increase over 1926 of 14 per cent.

Sales of natural asphalt and related bitumens, including bituminous rock, gilsonite, wurtzilite (elaterite), and ozokerite, at mines in the United States in 1927 amounted to 839,040 tons, valued at $5,819,600. Sales of bituminous rock, the chief product of this group, amounted to 796,100 tons, valued at $4,672,280, representing an increase over 1926 of 18 per cent in quantity and $0.52 per ton in average value.

Imports of native asphalt and bituminous rock into the United States during 1927 amounted to 158,097 tons, an increase over 1926 of 15,465 tons, or 11 per cent. Shipments from Trinidad (including Tobago) and Venezuela comprised 96 per cent of the total imports. The latter country made a notable gain over 1926 and seriously threatens to displace the former in first place. Exports of petroleum asphalt in 1927 amounted to 385,031 tons, a gain over 1926 of 163 per cent. This extraordinary increase reflects the rapid increase in use of petroleum asphalt throughout the world. Germany and the Netherlands ranked first and second, respectively, as importers of asphalts from the United States.

The Prospector—Jack of All Trades

MUCH has been written of the trials and tribulations of the prospector, his contributions to the mining industry, and the possibilities of encouraging his activities—in letters published in *E. & M. J.* of recent years. However, in our next issue, he attains the equivalent of front-page publicity, with a story recounting the operations of a Nevada prospector and his burro in successfully working a small quicksilver mine, in the White Mountains, west of Tonopah, Nev. The widely diversified duties performed by the one-man operator are of general interest, even in this age of specialized labor.

ROBERT M. CATLIN

A Biographical Sketch

By A. B. PARSONS

PROBABLY to no one but the subject of this sketch would it occur to use the word "loafer" in connection with Robert Mayo Catlin, manager of mines for the New Jersey Zinc Company, and, as such, directing head of the company's mine at Franklin, N. J., the largest producer of zinc in the world. Mr. Catlin, although born 75 years ago this June, goes to his office each day and is actively interested in company and civic affairs at Franklin. His has been an unusually busy and useful career, and yet he says that he has been "pretty much of a loafer," at least for the last 25 years. The question had been put, "What particular work has been the source of greatest satisfaction to you?" Mr. Catlin replied "To my mind, work is doing something you don't like to do; and I haven't done much of that since 1900." Then came the observation, with only a suggestion of a smile, that he had been a loafer most of his life. Incidentally, he did not know that he might be quoted, so the testimony should not be used against him.

Mr. Catlin was born in Burlington, Vt., and was educated at the University of Vermont, from which he has degrees of B.S., C.E., and E.M. His career as a mine manager started at Tuscarora, Nev., about 1880, ten years after the Union Pacific spanned the continent. Among others, he was manager of the Navajo, Belle Isle, Commonwealth, Nevada Queen, and Del Monte mines, in the Tuscarora district. The ore was rich in silver, much of it assaying $500 per ton. It was crushed in a stamp mill, roasted, and amalgamated in pans, ten tons representing a good day's run. The Navajo alone is said to have produced $5,000,000. These were the good old days when ore was ore, when silver was silver, and when miners were miners! The manager knew every miner by his first name, and they took interest in their work. Many men who later became prominent in the mining, political, and financial life out West—and in the East, for that matter—worked as miners in Tuscarora and the other Nevada silver camps. It was during this period that Mr. Catlin first saw the deposit of oil shale near Elko, Nev., that was to be the basis of his subsequent work in developing a process of extracting oil. One of his hobbies at this time was firearms, though, strangely enough, he never had much use for guns, even as a hunter. The mechanism interested him keenly, and the upshot was the invention of the well-known Catlin-Carr automatic rifle.

In 1895 Mr. Catlin went to South Africa to help his friend "Jack"—more elegantly, euphoniously and generally, John Hays—Hammond in developing the deep level gold mines on the Witwatersrand. On Mr. Hammond's recommendation, the Consolidated Gold Fields of South Africa sold properties along the outcrop of the banket and acquired holdings paralleling the outcrop, where it was necessary to sink deep shafts to exploit the ores. Mr. Catlin was general manager of eight of these mines for more than ten years, and to him belongs much of the credit for the efficient and profitable operations.

In 1906 Mr. Catlin concluded that he had been away from the United States long enough. His three children were growing up and he preferred that their education be completed in the United States. He realized that he had been out of touch with the mining industry in the United States for a long period, and that it would take time to re-establish friendships and make a new professional connection. Accordingly, he planned to take a vacation for a year. He boarded a slow boat and started for a leisurely trip home by way of London. At the first port of call, Beira, in Portuguese East Africa, he was surprised to be handed a telegram asking him to take charge of the zinc mines at Franklin, N. J. Apparently news of his pending return had gone ahead of him, and also reports of his highly successful work in Johannesburg. He had only a hazy idea of what the Franklin zinc mines were; and, anyway, he still cherished the notion of remaining unattached for a year, so he sent no reply.

Now, an active man enjoys a certain amount of the do-nothing life on a ship, but usually a couple of months is enough. So it was with Mr. Catlin. By the time he finally reached New York he was itching to get back in harness. Accordingly, he went straightway to Messrs. Edgar Palmer and August Heckscher, the owners of the Franklin property, to see if the job in New Jersey was still open. It was. After brief negotiation, Mr. Catlin went to Franklin to take charge, and he has been there ever since—"loafing" for 22 years.

The situation at Franklin was peculiar. According to well-known engineers who were familiar with the facts, the management had pronounced the mine "worked out." Mr. Catlin himself vouchsafes the statement that it was over-developed. At any rate the owners had contracts to fill, and they needed somebody who was an expert miner to get the ore for them. The orebody is a huge, irregular mass containing franklinite, willemite, and zincite, making a rich zinc ore. Levels had been established at 50-ft. intervals and numerous large lateral drifts and crosscuts had been driven to extract ore. Although only a small fraction of the deposit had been removed, skillful mining was necessary to win the remainder. This was Mr. Catlin's job. His first move was to arrange to obtain filling for some of the open workings, so as to avoid the collapse of vital portions of the mine. He then devised a novel method of mining—or rather he combined two well-known methods in a novel manner. The first step in the program was to raise narrow shrinkage stopes about 20 ft. wide, transverse to the strike of the deposit. Between these stopes 75-ft. pillars were left, which are now being won systematically by top slicing in 10-ft. slices. Mr. Catlin says that he developed virtually no new ore, although he has prospected thoroughly to satisfy himself that nothing is being overlooked. He sunk and equipped a splendid four-compartment shaft, and organized mine operations so as to extract the ore as cheaply as possible without losing any considerable tonnage. He has produced from a

"worked out" mine for twenty years, and though this writer has no official information on the point, there is every reason to believe that ore for a great many years ahead remains in the mine. Indicative of Mr. Catlin's mechanical flair, are numerous contrivances around the mine, mill, and power plant that were devised by him.

Ever since 1876, Mr. Catlin has been interested in the problem of the future supply of petroleum or some hydrocarbon substitute. He realized that the supply of petroleum in the world would be exhausted in a comparatively brief time; and he saw also that nature has locked up almost unlimited quantities of hydrocarbons in oil shale. Accordingly, when opportunity arose some years ago, he set out to devise a practical process for extracting oil from shale. Much effort and a considerable amount of Mr. Catlin's own money went into the project; but finally, after many remodelings, a plant was developed near Elko, which Mr. Catlin operated successfully long enough to satisfy him of its practicability. He cannot produce profitably in competition with "well" oil at the present price; but he has in his garage in Franklin 1,000 gal. of lubricating oil made in his Elko plant, and he has used no other oil in the engine of his automobile for five years. Mr. Catlin's fine record of research and achievement in the technology of oil shale has brought credit to the profession of mining engineering. According to "Who's Who in Engineering" Mr. Catlin served as president of the Mine Managers' Association of Witwatersrand in 1903 and 1904; he is a life member of the Advisory Board of The South African Association of Engineers; he is a life member of the American Institute of Mining and Metallurgical Engineers; and he served as president of the Mining and Metallurgical Society of America in 1925 and 1926. Little wonder that Mr. Catlin likes his present job. He is so near New York that he suffers from no violent desire to go there; yet he can do so easily if occasion arises; and anything he wants from New York can be obtained promptly. He has a pleasant home, for it would be hard to find a more attractive country than that surrounding Franklin. At the same time, operations are big enough always to provide the boss with something to think about. An excellent organization of department heads has been formed, however, and one surmises that the town of Franklin gets more of Mr. Catlin's attention than the mine and mill. He is an idealist in many respects, and he is deeply interested in the welfare of the workers. A commodious brick school house, an efficient looking fire station, an unusually large and well-equipped hospital, and a beautiful park are among the civic improvements of Franklin. An excellent golf course is a center of attraction; Mr. Catlin himself plays no golf, but regards the game as an indispensable tonic for the staff. Homes built by the company are sold to employees at cost plus a nominal profit; and of the 1,000 employees, about one-fourth are owners of their own homes. Mr. Catlin was asked about prohibition; possibly because he is a candidate for nothing, he discussed the matter frankly: "Plenty of applejack and other strong beverages are made and drunk, but I don't see a drunken man pass my office once a month, and before prohibition there were a half dozen every day. Only a few people owned homes under the old order of things. The saloonkeepers were the bankers. I called your attention to the new steel structure which is to be the enlarged home of the Sussex County Trust Company. I happen to be a vice-president of the bank, and we have hundreds of employees with savings accounts running well into the thousands. Whether prohibition is good for New York or not, I won't attempt to say; but it is good for Franklin, N. J., and for the New Jersey Zinc Company."

A skillful miner, a true pioneer, a prominent mining engineer, an ingenious inventor, a successful executive, and a sympathetic employer; a keen student of life, something of a philosopher, and, if a loafer, at least a most engaging one—is R. M. Catlin.

Flotation of Low-Grade Phosphate Ores

By H. M. Lawrence and F. D. DeVaney

Metallurgist, U. S. Bureau of Mines, Tuscaloosa, Ala., and Junior Mining Engineer, U. S. Bureau of Mines, Rolla, Mo., respectively

RECOVERY of phosphate rock from the ores in the land-pebble district of Florida is a simple washing and screening operation, according to investigations conducted by the U. S. Bureau of Mines. In the washing plants, coarse phosphate only is saved. Log-washer overflows and screen-undersize products containing an appreciable content of fine phosphate are discarded. The phosphate grains in the material discharged to waste are generally finer in size than the mesh—14 to 20 mesh or 0.03 in.—of the finest screen in the washer. The operators state that the washers ordinarily recover from 50 to 60 per cent of the phosphate content of the matrix mined. Any increase that can be effected in the recovery of phosphate would be of advantage to the industry and would conserve the mineral resources of the country.

In considering possible methods that might increase the recovery obtained in phosphate-washing plants, the application of flotation, if it could be successfully developed, seemed to warrant investigation.

Flotation has been applied, in the laboratory at least, to the beneficiation of Spanish phosphates.[1] An investigation of flotation for Florida phosphates is now under way. In this study the work here reported has been confined largely to screen-undersize products rejected by the washers. Such material is granular and practically free from clay. Also, these undersize products frequently have a phosphate content but little below that of commercial rock, and only require the removal of small amounts of quartz gangue to render them marketable.

Only phosphate ores from the land-pebble district of Florida have so far been studied. The phosphate minerals in these deposits vary in physical and chemical properties. Some of the phosphate grains are hard, well rounded and polished, and black. There are all gradations between pebbles of this type and the soft, white, amorphous variety that is also common.

In composition, the phosphate minerals are complex, containing lime, magnesia, iron, alumina, fluorine, and organic matter in addition to the lime phosphate. The P_2O_5 content of the different types of phosphate grains varies; in general, it may be said that the P_2O_5 content of the light-colored grains is higher than that of the black grains. From some of the phosphate ores it has not been found possible to obtain a segregate of clean mineral which will contain over 73 to 74 per cent B.P.L. (bone phosphate of lime); these phosphate grains showed no attached quartz particles when viewed under a microscope. From other ores clean picked grains with no visible quartz may contain 78 to 80 per cent B.P.L.

For flotation testing, the ore—minus 10 mesh in size—was ground in an Abbe pebble mill to pass 48 to 65 mesh with 50 to 92 per cent minus 200 mesh. In grinding, the softer phosphate grains were ground finer than the more resistant quartz. Standard procedures for flotation testing were followed. In some cases a clean concentrate and a low tailing were made in a single pass. Ordinarily, however, rougher tests were followed by cleaning runs, and the cleaner tailing was added to the pulp for the succeeding test. The M.-S. hollow-shaft type, and 50-gram laboratory machines were used.

As preliminary work indicated that oleic acid and sodium oleate would give some selective action between the phosphate and quartz reagent, combinations have been mainly limited to those containing these two reagents. Results have been obtained in the laboratory machines with several charges; two are listed herewith.

Amount of Flotation Reagents Used

	First Charge, Pounds per Ton	Second Charge, Pounds per Ton
Oleic acid	1.6	...
Sodium oleate	.04	3.0
Heavy crude pine oil	.8	...
Pine oil (steam distilled)	.6	.6
Sodium silicate	.24	1.4
Sodium carbonate	.2	...
Mexican heavy crude petroleum oil	...	.6

In general, in the tests in which the first combination was used, the insoluble content of the concentrates was a little lower than when other charges were employed. With the second combination the phosphate content in the tailing tended to be somewhat lower.

In the laboratory tests the cost of the reagents used amounted to 25 to 35c. per ton of material treated. Frequently, in flotation practice, the consumption of reagents is reduced materially from the amounts required in small-scale laboratory tests. There are possibilities for decreasing the reagent consumption if the flotation of phosphates should be applied commercially, particularly if soft water is used.

In the tests so far made, distilled water has been used exclusively. The water supply in different parts of the country where flotation of phosphates might be practiced will vary in quality. Impurities in the water which tend to make a water hard will consume a certain amount of reagents, more particularly sodium oleate or similar chemicals. This consumption of sodium oleate results from the formation and precipitation of insoluble oleates when calcium salts are present in the water. Water softening may have to be practiced to prevent an excessive consumption of reagents.

The results of two typical tests are tabulated below. Test A was performed on a sample of undersize rejected by the reclaimer screens from one of the washers which treats a matrix containing mainly light-colored phosphate. Test B was made on a similar material from a washer treating matrix in which black grains of phosphate predominate.

Test A

Product	Weight, Per Cent	Assay, Per Cent B.P.L.	Assay, Per Cent Insol.	Phosphate Recovered, Per Cent	Insoluble Rejected, Per Cent
Feed	100.0	48.5	37.4	....	....
Concentrate	54.6	75.1	4.3	84.6	....
Tailing (including middling)	45.4	16.4	77.1	....	93.7

Test B

Feed	100.0	33.5	54.5	....	....
Concentrate	22.4	71.8	1.9	47.9	....
Middling	22.3	57.7	21.3	38.4	....
Tailing	55.3	8.3	89.2	....	93.5

Middlings from several tests have been re-treated, producing concentrates and tailings with analyses similar to those given in Test B. The indicated recovery would

[1] Broadbridge, W., and Edser, E.: U. S. Patent 1,547,732. July 28, 1925.

then be 85.1 per cent of the phosphate with a rejection of 98 per cent of the insoluble. In several other tests tailings containing from 1.5 to 3.0 per cent B.P.L. and concentrates containing 2 to 4 per cent insoluble were obtained.

In general, concentrates from ores in which the lighter-colored grains predominated contained more phosphates for equivalent amounts of insoluble than did the concentrates obtained from ores in which the major portion of the mineral grains was black.

Although the results so far obtained in this investigation cannot be applied directly to commercial practice without further research, they do indicate that flotation gives promise for the beneficiation of phosphates. Further investigation along similar lines may develop a process which will yield higher recoveries of phosphate rock from the ores now mined, and thus permit profitable operations on leaner deposits, or warrant re-treatment of débris—washer reject—discarded in previous operations. Smaller tonnages of matrix could be mined to maintain a given production program, and reserves of phosphate rock would be depleted less rapidly. The collaboration of Will H. Coghill, acting in an advisory capacity, is hereby acknowledged.

Concentrating Graphite in Southern California

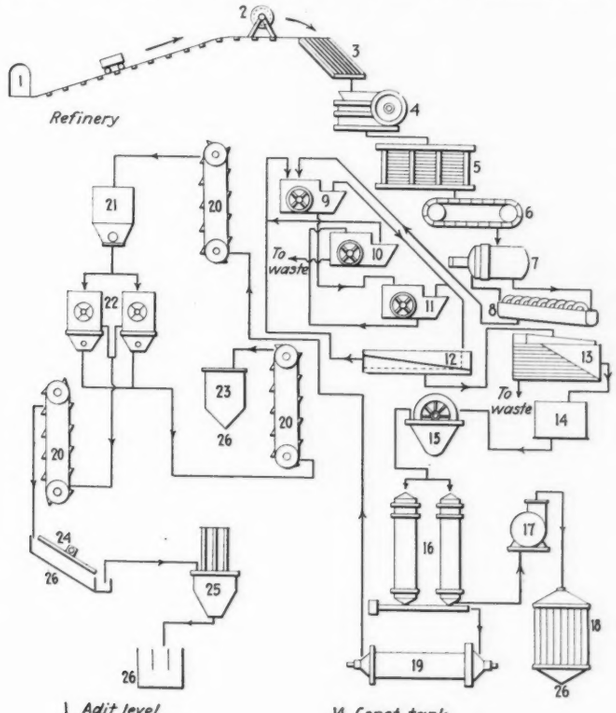
By W. G. HUBLER

Superintendent, Standard Graphite Corporation, Glendale, Calif.

THE plant of the Standard Graphite Corporation is situated about 15 miles north of Los Angeles, in the Verdugo Hills. Its location is ideal—in sharp contrast to that of the usual mining camp. The hills are heavily timbered with live oak abounding with small game. Cheap power and water, together with the mild climate, make for the best operating conditions.

The graphite is crystalline and occurs as small flakes finely disseminated through the schist. The ledge is enriched for a width of about 100 ft., with lenses of high-grade ore varying from six inches to fifteen feet in width. Although the deposit has been worked for the last thirty years (on and off) there is no development work at depth, and all the ore extraction has been accomplished by shallow tunnels and open cuts.

Flow Sheet of the Standard Graphite Corporation Mill



1 Adit level
2 Electric hoist
3 Grizzley
4 Jaw crusher
5 Ore bin
6 Feeder
7 Ball mill 4'x4'
8 Akins classifier
9 10' K and K flot. machine
10 6' K and K flot. machine
11 6' K and K flot. machine
12 8' Pneumatic Callow
13 No.6 Wilfley table
14 Concl. tank
15 4'x3' Oliver filter
16 Rotary driers
17 Drier exhaust fan
18 Baghouse
19 Cottrell regrind mill
20 Elevators
21 Cooling bin
22 Bolting machines
23 Barrelling bin
24 Cottrell suction screen
25 Baghouse
26 Finished product

Until the development of the flotation process for graphitic ores, very little graphite of a commercial grade was produced, as none of the ore is sufficiently high grade to market without concentration. A combined flotation and screen refining process is now in operation which produces graphite that compares favorably with any on the market.

The ore is crushed in a jaw crusher to 2-in. size and reduced in a 4x4 Standard ball mill in closed circuit with an Akins classifier. Classifier overflow is treated in three K. & K. flotation machines in series. The K. & K. concentrates are cleaned in a local pneumatic cell of the Callow type. Cleaned concentrate is tabled on a No. 6 Wilfley table to remove some iron mineral and coarse gangue which is entrapped mechanically in the dense froth produced. Mill heads carry 4 per cent iron oxide (as Fe_2O_3) which is largely dropped in the flotation.

The concentrate is pumped to a tank for thickening, and filtered on a 4x3 Oliver filter, the filter cake being dried in two rotary driers, gas fired on the outside. The hot stack gases are returned through the driers in direct contact with the concentrates. Circulation of the heat and discharge of the steam is maintained by means of a suction fan.

Partly nodulized dry concentrates are reground in a 3x6 ball mill loaded with slugs. The ball mill discharge is elevated to a cooling bin, and after cooling is treated in two bolting machines in parallel. The bolter undersize is sold as foundry facing. It is treated on a Cottrell suction screen to clean the flake. Flake produced is 60, 100, 150, and 200 mesh. The product from the baghouses gives an excellent grade of paint material.

Owing to the nature of graphite, screening has always presented difficulties not met with in screening a heavier or more granular material. In conjunction with the Cottrell Engineering Company, a screen was developed which gives perfect satisfaction. The screen is actuated

by an unbalanced pulley at the rate of 3,200 vibrations per minute, and is open on top with a strong suction applied to the bottom. The suction at once eliminates the fine portion and holds the flake in contact with the screen, the strong vibration being sufficient to move the material along.

Graphite is one of the minerals having few production difficulties, but a big marketing problem. In normal times the domestic mines find it difficult to compete with the importations from Madagascar and Ceylon, and it is only in time of war that the domestic production really becomes important.

Pure Metals and Modern Metallurgy

ALMOST interesting development in metallurgy in recent years has been the production of metals of extraordinary purity, a tendency discussed by C. L. Mantell in *Black and White*. Zinc has been produced, although not as yet in commercial quantities, with a purity of 99.99996 per cent zinc, and spectroscopically free from other metals. In contradistinction to ordinary zinc, this material is very slowly soluble in dilute sulphuric acid, which rapidly attacks commercial zinc. In dilute hydrochloric acid it loses only 0.02 per cent of its weight in the same time that a similar piece of commercial high-grade zinc entirely dissolves. Spectroscopically pure zinc has unusual softness and a low recrystallization temperature which prevents strain hardening in rolling.

Lead has been produced by double electrolytic refining so that it contains only 0.0003 to 0.0005 per cent impurities. Sulphur-free nickel, often declared impossible of production, even a decade ago, is now a regular commercial product. The use of pure nickel that is of the greatest interest at the present moment is its application as a malleable product for the manufacture of certain types of machinery and apparatus. It is also used in the industries dealing with foods, as, for example, those handling milk in dairies. Pure nickel is free from just those defects which cause difficulties with glass lined or "tinned" copper tanks.

As a result of recent research, pure refined aluminum, of a purity of 99.96 per cent, is rapidly becoming a commercial product. It is much more resistant to corrosion than ordinary aluminum, and holds its luster almost indefinitely in the atmosphere, while ordinary aluminum luster acquires a bluish cast due to the corrosion film of aluminum oxide.

Electrolytic iron, 99.965 per cent iron, with 0.006 per cent carbon, 0.004 per cent sulphur, 0.005 per cent silicon and 0.005 per cent phosphorus, is another new product possessing promising features, although it is questionable whether ordinary low-carbon iron and deep-drawn steel stock will not do almost as much as the electrolytic iron will. After annealing it can be drawn down to of $\frac{1}{16}$ of its original diameter, without need of further annealing, whereas steel requires several annealings in drawing down to fine sizes. Electrolytic iron has a ductility almost as great as that of copper. Its corrosion resistance is markedly superior to that of steel.

Electrolytic tin has been produced of a purity of 99.996 per cent tin metal. It is softer than commercial tin, and has unusual ductility.

Copper, refined under carefully controlled conditions, has been produced of 100.6 per cent conductivity on the Mathiessen standard; the usual electrolytic copper is under 100 per cent conductivity.

It is characteristic of pure metals that their corrosion resistance increases, that their conductance increases, and that they are more readily rolled to extreme thinness or are drawn to very small sizes without annealing. It has even been said with prophetic intent that we may look forward to a future of pure metals, produced in commercial form, which will give us many of the desired products we now have in the form of alloys, which the pure metals will eventually displace.

The last ten years have brought forth a number of new electroplated metal surfaces which could not previously be electroplated. The application of cadmium to aircraft structural parts, chromium to automobiles and hardware, and alternate platings of copper and nickel with a final nickel finish, have given the world surface finishes of beauty and utility. Alloy plating research has given us permalloy, a material of great value to the electrical industries.

Another phase in the present trend of metallurgy is the gradual inroads low-temperature methods of winning metals from their ores have made on the high-temperature thermal methods. Examples of these are the present production of iron sponge by gaseous reduction and the application of the same methods to the ores of lead, tin, arsenic, antimony, mercury, and other non-ferrous metals. Slags are eliminated, difficult refractory problems are almost completely obviated, production costs are cut down, and greater fuel and energy efficiencies are attained.

Magnesium of Increasing Use in Light Alloys

MAGNESIUM ALLOYS are now being extensively used in airplane construction, says *The Metal Bulletin*. The machine of General de Pinedo, the Italian who flew to America and back in the spring of last year, was to a large degree made of magnesium alloys which, being some 40 per cent lighter than aluminum, are considered to have an unlimited field of use. It is reported that the Junkers aircraft concern is contemplating employing magnesium alloys for the bodies of airplanes to be used in future ocean flights. German automobile manufacturers are already using them both in lorries and passenger cars. Many countries seem to be interesting themselves at present in these light alloys, both for commercial and national defence reasons. The raw material, magnesite, is found on a large scale in nearly every land. Magnesium alloys bid fair to compete directly not only with aluminum but also with iron, as it is claimed that they are easy to work and that the cost of the finished product is comparatively cheap owing to its lightness. There is evidence that the importance of magnesium as a means of freeing Germany from dependence on outside sources of raw material for the manufacture of light alloys is not being overlooked in that country. It is pointed out that thanks to the carnallite content of her huge potash deposits, Germany is able to produce magnesium much cheaper than can be the United States.

COMMENT AND CRITICISM

Agriculture vs. Hydraulic Mining

THE EDITOR:

Sir—In all the arguments in favor of hydraulic mining presented during the existence of the hydraulic impounding laws of California, the strongest, in my opinion, has been utterly ignored.

The argument that the débris was filling up the streams to the detriment of navigation has been frequently made. I want to call attention to the fact that when California was a cattle country, covered with grass, the streams did not fill up, but when Honest John, the farmer, plowed up the grass and laid open the plowed fields to erosion from both rains and irrigation, their operations carried more fine silt into the streams than all the hydraulic operations of the state could carry into it in 1,000 years.

Permit me to cite the fact that, even within the memory of many who are now living, steamboats from the Mississippi River went up the Des Moines River as far as Fort Dodge. Iowa was a prairie country then. Today a rowboat could not go from Fort Dodge to the Mississippi except in high water. Fifty-four thousand square miles of the state of Iowa has been plowed up. Rainstorms have furrowed deep gullies in the plowed fields. The agricultural papers are today devoting space to the protection of fields that are badly eroded by rains.

About the middle of May, 1928, I rode from Chicago to Des Moines on the Rock Island road during a heavy rainstorm. I saw plowed fields near Iowa City that had been almost destroyed by the rain, with great gulches, 20 ft. wide and 6 ft. deep, that had carried the silt downhill until it was spread more than a foot deep over a roadway, and no hydraulic mining is going on in Iowa. Nevertheless, the streams are filling up.

Forty years ago, railroad cars were ferried across the Missouri River at Omaha. In early days the Missouri River packets navigated the Missouri as far as the Montana state line. Now, the Missouri River is so low at some seasons of the year that fishes have to stand on their heads to get a drink because of the silt that was carried into the river when Nebraska and Dakota were plowed up.

I am citing these conditions at places that are so distant from hydraulic mining that the question of hydraulics cannot be brought into the argument.

The Grange was organized by the agriculturists of California just prior to the passage of the impounding law. Politicians, desiring to be elected to office, preyed upon the Grangers' prejudice against mining, to get their votes. They cited the malaria-infested country around Marysville, perhaps the only part of the state that really had any kick against hydraulic mining until the Grangers voted for the politicians.

The farmer is a permanent resident. The miner is migratory. Politicians elected to office expect the farmer to vote for them at the next campaign. Congressmen distribute seeds among the farmers year after year at the expense of the Department of Agriculture. The farmer is the pampered pet of the politician because he is a permanent resident and votes in the same place year after year, yet it was the plowing up of the fields of California more than the heavy tailings of the hydraulic mines that filled the navigable streams.

Today, after more than 40 years of hydraulic idleness, the Sacramento River and other navigable streams are cluttered with dredges removing the silt that is still accumulating despite the total absence of hydraulic mining.

Thirty to forty million dollars' gold production has been curtailed in California. What for? Political votes.

Tonopah, Nev. LETSON BALLIET.

Post Mortem on Oregon's Famous "White Metal" Mystery

THE EDITOR:

Sir—A letter, with enclosure from the U. S. Geological Survey, received from the Commissioner of the General Land Office, concerning the late "white metal," "mystery metal," and tin controversy, of southern Oregon, seems to give the controversy a final and authoritative touch. I quote as follows from the letter of the Commissioner:

"In this connection, I have to state that information was received in May, 1927, from the Division Inspector at Portland, Oregon, tending to show a discovery of tin in Douglas, Jackson, and Josephine counties, Oregon. In June, 1927, it was reported that there was considerable excitement at Canyonville, Grants Pass, and other places in Oregon, owing to the alleged discovery of what has been called 'white metal.' Three samples of the latter metal reported to have been recovered from rock taken from lands in Douglas and Josephine counties were sent to the Geological Survey for analysis. That bureau made a quantitative analysis of the samples and submitted a report. . . .

"In December, 1925, the Bureau of Mines issued a circular (No. 6000) entitled 'The Legendary White Metal and its Ores.' There is nothing in said circular to justify the claims that have been made asserting the discovery of a so-called 'white metal' having very unusual qualities. On the contrary, the conclusion is reached 'that the various unsubstantial claims that have been made were due to careless tests, to erroneous conclusions from these tests, or to an attempt to defraud.'"

The letter from the Acting Director of the Geological Survey says:

"The three samples of alloys transmitted with the letter have been examined qualitatively in the Survey laboratory. Quantitative analyses have not been made, as the nature of the material does not seem to justify this more elaborate and expensive type of examinations.

"Samples Nos. 1 and 3 consist of lead, antimony, and tin, the lead predominating. Tests were made for arsenic, cadmium, copper, cobalt, nickel, and zinc, but these metals appear not to be present.

"Sample No. 2 also consists essentially of lead, antimony, and tin, but the proportion of lead is larger than that in samples 1 and 3, and the proportion of tin is smaller—quite small, in fact. This sample also contains a trace of copper.

"These samples therefore consist of alloys of common metals of types quite usual in certain commercial babbitt metals and solders. Alloys of this kind are not found in nature, nor would minerals containing these metals be expected in such natural association as to yield such alloys by treatment of the kind described by Mr. Boyer.

"Although you submitted no samples of the ore from which this material is purported to have been extracted, and while, possibly, a final opinion, therefore, is not justified, I feel that I am fully warranted in expressing the preliminary opinion that the metals represented in the samples were introduced by human agencies, accidentally or otherwise, either before or during the processes by which they were purported to have been extracted from the rock that was supposed to contain them."

Portland, Ore. W. H. HAMPTON.

[Since receiving the foregoing we have learnt that the "white-metal" excitement in southern Oregon is not over. In fact it has received a fresh impetus by a recent announcement that a process has been discovered that "From the standpoint of gold recovery alone . . . bids fair to change the gold mining method of the whole coast, for he [the inventor] claims that in handling a hundred tons of ore a day or more, his process can be operated at a cost not to exceed one dollar a ton for mining and recovery. . . . What the solving of this problem means to Oregon and to other western states," continues the statement, "in which these peculiar ores are found is almost beyond conception, when one understands that the thousands of otherwise worthless mountain ranges can now be made to produce values ranging around a hundred dollars a ton in tin, gold, platinum, lead, bismuth, cadmium, palladium, iridium and in fact

the whole run of commercial, precious and rare metals." No details of this marvelous process are as yet available.—EDITOR.]

A Correction

THE EDITOR:

Sir—In the issue of June 2, on p. 911, in a news item concerning the Dickens Consolidated mine, the statement was made that the shaft seems to have passed through the Pritchard and entered the Revett quartzite formation. This statement is not correct. The Revett formation is younger than the Prichard and is younger than the Burke. The Prichard is predominantly a slate, but contains some beds of quartzite which look like the Revett. The Dickens mine is in the quartzite of the Prichard, and not in the Revett formation. GUY E. INGERSOLL.

San Francisco, Calif.

Raconite—a New Xanthate

THE EDITOR:

Sir—I have read, with interest, Professor Gaudin's letter published on page 859 of *Engineering and Mining Journal* of May 26, 1928.

Professor Gaudin's remarks about the higher alcoholic xanthates were of interest to us here at the Hayden plant of Nevada Consolidated Copper, because it was here that I made the discovery and obtained a patent on the use of such xanthates in flotation.

This plant has been using one of the Stevens' patent higher alcoholic reagents since early in 1926, after thoroughly testing it and finding it superior to the ethyl xanthates previously used.

I discovered the value of the higher alcoholic xanthates in 1924, and applied for patent, during that year, on their use in flotation. U. S. Patent No. 1,594,859 was granted on Aug. 3, 1926, application having been filed on Aug. 23, 1924.

It was discovered that by using an excess of carbon bisulphide and alkali with fusel oil, a reaction product was obtained which gave not only a higher yield from the alcohol, but resulted in the reaction of the excess carbon bisulphide and alkali to form products which appeared to improve the reaction mixture for flotation purposes. The character of the mineralized froth produced by the new compound showed a flotation agent of superior quality.

Other higher alcohols in the series were investigated and found superior to ethyl in flotation action. Equimolecular combinations of the higher alcohols, carbon bisulphide and alkalis were made, and the resulting higher alcoholic xanthates were found to be very effective flotation agents, possessing frothing as well as collecting power.

A reagent manufacturing plant was erected and has been producing what has been termed locally as "Raconite" since early in 1926. Raconite is the reaction product of carbon bisulphide, caustic soda, and butyl alcohol, the carbon bisulphide and alkali being used in excess above that theoretically required to react with the alcohol. Various proportions, and other alcohols and alkalis could be used, but the above mixture has given very satisfactory results. Its rapid action in collecting the mineral has permitted a marked reduction in the number of machines necessary to make the recovery. J. L. STEVENS.

Hayden, Ariz.

Greensand for Softening Water

THE EDITOR:

Sir—I note under "Consultation," in your issue of May 26, page 862, "Market for Greensand," an article that leads one to believe that the use of greensand to soften water is patented. The base-exchange properties of the so-called zeolites have been known since about 1855. Greensand is a natural product, so no patent can prevent its use in softening water; however, when used for softening water in its raw stage, it has a tendency to give up a green color for a month or so, or until thoroughly washed. The process patent of the Permutit Company covers one of the several patents taken out by the various companies to stabilize or fix the sand, so that it will not give off this green color at the start. A broad claim in one of the patents of the Permutit Company recently purchased from the Fort Wayne Tank & Pump Company attempts to cover all methods of stabilizing. A good washing is about all it needs for this purpose.

The Permutit Company has an apparatus patent covering the removal of the spent brine solution from the lowest part of the tank; it is this patent that gives the company practically a monopoly in the use of zeolites for softening water. This patent covers all zeolites, synthetic and greensand.

New York City. TECHNICIAN.

Consultation

U. S. Mineral Supply and Requirements

"What minerals and metals are produced in sufficient quantity in the United States to meet domestic requirements, and on what must we depend on imports for most of our supply?"

THE following enumeration, in part attributable to Representative H. L. Englebright, should answer the correspondent's question:

I. Minerals of which our exportable surplus dominates the world situation: copper, molybdenum, and petroleum.

II. Minerals of which our exportable surplus constitutes an important, but not a dominant, factor in world trade: sulphur, phosphates, silver, iron and steel, and coal.

III. Minerals of which our exportable surplus is not an important factor in the world trade: lead, zinc, aluminum and bauxite, gold, asphalt and bitumen, pyrite, fluorspar, cadmium, gypsum, lime, tripoli and diatomite, mineral paints (except umber sienna and ocher from France and Spain), pumice, granite, salt (except special classes), talc, arsenic, bismuth, bromine, artificial abrasives, corundum and emery (except Naxos emery) and fuller's earth. Small amounts of most of these minerals have been imported because of special grades or cheaper sources of foreign supplies, but these imports for the most part are incidental.

IV. Minerals for which the United States must depend almost entirely on other countries: tin, nickel, platinum and metals of the platinum group.

V. Minerals for which the United States will depend on foreign sources for a considerable fraction of the supply; antimony, vanadium, zirconium, mercury, mica, monazite, graphite, asbestos, ball clay and kaolin, chalk, cobalt, Naxos emery, tungsten, and grinding pebbles.

VI. Minerals normally imported into the United States which in the future can be largely produced from domestic sources if found technically and economically practicable: nitrates (except potassium nitrate), potash, manganese, chromite, uranium, radium, and magnesite.

Economic Applications of Dumortierite

"In your issue of May 12 occurs mention of dumortierite. I would appreciate any further information about this mineral."

ALTHOUGH dumortierite has been known as a mineral species since 1879, it is only of recent years that it has become of economic importance in the non-metallic mineral field. Its occurrence is comparatively rare, and only a few commercial localities are known. The mining of this mineral is confined to a single locality near Oreana, Nev.

Dumortierite belongs to a group of high alumina silicates, but differs from andalusite, sillimanite, and cyanite in having boric anhydride as an essential constituent. The development of special refractories has been responsible for commercial development of these minerals.

Knopf recognized dumortierite in the Rochester, Nev., area. He also pointed out the occurrence of andalusite in the Inyo range of California. Subsequently a larger deposit was discovered in the White Mountains, and this was exploited. A large deposit of cyanite is being exploited north of Ogilby, Calif., and is being used in the manufacture of special refractories. Some dumortierite has also been discovered in that locality.

INDUSTRIAL PROGRESS

The Equipment Review

A MACHINE which has been developed primarily for coal mining purposes, but which can be used for handling other materials, is the new Whaley single-motion shovel just introduced by the Myers-Whaley Company, Knoxville, Tenn. This shovel was first introduced to the public at the Cincinnati Exposition, May 7 to May 11 last. It is shown in the accompanying illustration. It consists of a simple non-automatic shovel motion applied to the front end of the Myers-Whaley shoveling machine in place of the double-action automatic shovel. The shovel itself is 46 in. wide, is pivoted to the front end of the front conveyor, and has ears on each side, to which are attached lifting rods for raising and lowering the front or lip of the shovel. These rods are actuated by crank arms on a cross shaft on the yoke, which supports the front end of the conveyor. This shaft can be thrown in or out by means of a clutch. After moving the machine under its own power into a prepared space, the operator drops the shovel down, and then crowds the entire machine forward, thus forcing the shovel under the material to be loaded. When the shovel is filled, he throws in the lifting clutch, raising the front end of the shovel to an angle which causes the load to slide off backwards and onto the belt conveyor, which carries it back. The shovel will lift 8 or 10 cu.ft. of coal (other material to correspond) at a time. The clutch is so arranged as to permit the shovel to be held in its lifted position until the belt has taken all of the load.

The new Whaley single-motion shovel loading rock underground

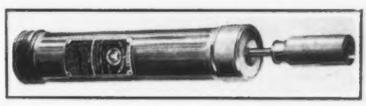
A ¾-yd. shovel and crane operated by a 72½-hp. gasoline motor

Another material-handling machine is the Type 1030 ¾-cu.yd. gasoline shovel and crane introduced by the Bucyrus-Erie Company, Erie, Pa. It is provided with a 72½-hp. gasoline motor which gives it about 30 per cent more power than provided on previous models of this size. This additional power permits a 6½ to 13 per cent faster swing and increases the speed of the hoist motion as well. To take care of the greater speed, oversize contracting band clutches are used, with a large brake of the contracting shoe type to stop the swing. The machine is mounted on caterpillar treads. This mounting has a two-way brake which quickly locks the machine in either direction while permitting free travel in the opposite direction.

The General Electric Company has revised its line of crane protective panels designated as CR-7409. These panels provide overload and undervoltage protection for all motors of a crane and are designed to use with an emergency switch. The principal change in the line is a regrouping of the units involved, resulting in a decided reduction in total size. This is an advantage, inasmuch as the space in most crane cabs is limited. Another change is the substitution of instantaneous overload relays instead of dashpot overload relays. Otherwise the equipment is practically the same as before, save that up-to-date material is used.

Blasting

A shot-firing unit, shown in the accompanying illustration, has recently been introduced by the National Carbon Company. It is known as the No. 2696 Eveready unit; and is applicable for all conditions where blasts are fired one at a time, either underground or on the surface. It draws its current from a dry-battery cell contained in the cylinder of the unit, which is compact and light in weight. The unit resembles a flashlight in appearance. When it is desired to blast with it, wires are run from the cap and fastened to a special plug, which is then inserted in a small socket at the end of the unit and held there against the pressure of a spring inside. As soon as the hand is removed, the plug is disconnected, being forced out of contact by the spring.

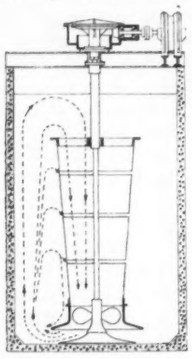


An electric single-shot firing unit

Agitation

An agitator designed primarily for the portland cement trade, but which may be applicable in metallurgical work, has been introduced by Smith and Smith, 15614 Detroit Avenue, Lakewood, Ohio. This is known as the Venturex slurry agitator. It is

shown just below. In its design, a circulatory system is obtained within the tank through the medium of an internal submerged cylindrical shell, the shell in this case being a Venturi tube. In the throat of the tube is a power-driven propeller. The Venturi form is much modified in the lower portion, which consists of a cast-iron propeller casing bolted to the bottom of the tank. In this device the upper cone is of sheet-steel construction stiffened by cast-iron rings at either end. The lower ring has guide lugs engaging with guide studs in the fixed base; and the upper ring is guided by a tube fixed and projecting into the tank from above. The movement of this sheet steel cone gives the effect of a valve opening directly above the propeller,



This agitator may have other applications than in the cement industry for which it was designed

and is useful only on filling and emptying the tank. Annular slots in the cone arranged at the proper heights combine the functions of mixing channels, by reason of the extra currents developed in regular operation, and also serve to maintain the slurry (or other substance) level inside and outside of the Venturi tube when filling or discharging the tank. The cone is raised or lowered either by hand or by power. In operation, to fill the tank the cone is lifted and the motor started. The propeller almost at once begins agitating the incoming slurry. When the tank is full, the cone is dropped during normal agitation. When the tank is to be emptied, the cone is again raised and the propeller agitates the slurry to the last practical moment.

Conveying

A new vibrating conveyor has been turned out by the Traylor Vibrating Company, 1400 Delgany St., Denver. This piece of equipment is a self-contained, compact unit and operates without belts or pulleys. No special electric current is required, inasmuch as the conveyor will operate from any standard alternating current, with the generator set which is furnished with it. Power consumed does not exceed 1 hp. The surface may be 20, 36, or 48 in. wide. This conveyor is adaptable for feeding crushers, screens, and similar machines; also for distributing material to storage, for loading cars, and for bypassing purposes.

A single-retort stoker of the underfeed type

Steam Plant

A single-retort stoker of the underfeed type, and having a flexible grate motion in combination with power-operated dumps, is shown in the accompanying illustration. It is made by the Westinghouse company, which maintains that its use has contributed largely to the success attained in handling burning fuel, with minimum labor and attention, in furnaces of wide dimensions. The unit affords complete flexibility as to the coal feed and distribution, combined with an easy means of dumping the refuse. This makes it possible to maintain a uniform temperature in the furnace, an advantage in heat-treating steel.

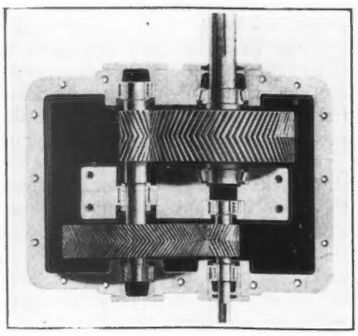
Mining Machine

Machinery primarily intended for cutting coal may in some cases be adapted to other purposes. This is the case with the Sullivan Machinery Company's so-called short model low (12-in.) longwall Ironclad coal cutter, which has just been announced in Bulletin 82-D by the company. One of these machines is shown cutting 6-ft. under a 6-ft. seam of potash in Alsace. Tungsten steel bits are used, 80 to 120 ft. of face being made per eight hours shift. The temperature of the workings is over 90 deg.

Transmission

A new double-type continuous-tooth herringbone speed reducer has been introduced by the D. O. James Manufacturing Company, Chicago. It is shown in the accompanying illustration. This new reducer is equipped with Hyatt roller bearings on high, intermediate, and slow-speed pinion shaft, and with Timken roller bearings on slow-speed gear shaft.

Two types of roller bearings feature this reducer



BULLETINS

FLOOD LIGHT—Oxweld Acetylene Company, 307 Railway Exchange Building, Chicago. A sixteen-page pamphlet on the "Carbic" light.

TUBE COUPLINGS—The Parker Appliance Company, 10320 Berea Road, Cleveland. A 24-page pamphlet.

SCREENS—The Ludlow-Saylor Wire Company, St. Louis, Mo. Pamphlet, 20 pages. "Controlling Crusher Wastes With Woven Screens."

WELDING — General Electric Company, Schenectady, N. Y. Bulletin GEA-874. Type WD-200A arc welder. Also bulletin GEA-881 covering this welder driven by a gas engine.

MOTORS — General Electric Company, Schenectady, N. Y. Bulletin GEA-865. Multi-speed induction motors.

STEEL WINDOWS — Bogert & Carlough Company, Paterson, N. J. Catalog J-28. "Boca" projected steel windows.

INSULATION—Celite Products Company, 1320 South Hope St., Los Angeles. Bulletin No. 101. "Sil-O-Cel" insulating materials and allied products. Sixteen pages.

GEARS—W. A. Jones Foundry and Machine Company, 4401 West Roosevelt Road, Chicago. Herringbone gears. Twenty-four pages.

ROLLS — Allis-Chalmers Manufacturing Company, Milwaukee, Wis. Bulletin No. 1816-B. Crushing rolls. Twelve pages.

PLUGS, RECEPTACLES — Crouse-Hinds Company, Syracuse, N. Y. Bulletin 2111. Sixteen pages.

MOTORS—Reliance Electric & Engineering Company, 1053 Ivanhoe Road, Cleveland, Ohio. Bulletin 1087. Four pages.

COUNTERS — The Bristol Company, Waterbury, Conn. Bulletin No. 365. Six pages.

STOKERS, GRATES—Combustion Engineering Corporation, 200 Madison Ave., New York. Two reprints of articles entitled "Design and Application of Traveling Grate Stokers" and "Design and Application of Forced Draft Chain Grates." Free on request.

STEAM GENERATORS—La Mont Corporation, 200 Fifth Ave., New York. A four-page pamphlet. La Mont steam generators.

LOCOMOTIVES—Five new publications on Baldwin-Westinghouse mine locomotives have recently been issued by the Westinghouse company. They are respectively reprints 319, 323, 324, 325 and leaflet 20,356.

D.C. FEEDERS—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Leaf-slip L. 20115-A. Automatic d.c. feeder equipment for mining service. Two pages.

PATENTS

COKE OVEN. No. 1,671,194. May 29, 1928. Heinrich Koppers, assignor to The Koppers Development Corporation, Pittsburgh, Pa.

Process for coke-oven heating and the like.

RETORT OVEN. No. 1,671,195. May 29, 1928. Heinrich Koppers, assignor to The Koppers Development Corporation, Pittsburgh, Pa.

ANTIMONY. No. 1,671,203. May 29, 1928. Hans Nuhn and Lewis H. Blood, assignors to Antimony Products Corporation, New York.

This covers a method of preparing antimony sulphide.

NEWS OF THE WEEK

Summary

MOVEMENT is renewed to transfer U. S. Bureau of Mines from Department of Commerce to Department of Interior. Impending departure of Secretary Hoover creates feeling that needs of Bureau and industry can better be met by such a change. Page 1066.

* * *

Smelter unit will be built at Copper Cliff by International Nickel to treat ores from Frood mine. Company's construction program also calls for new electrolytic units at Port Colborne. Page 1070.

* * *

Draft agreement drawn up between South African and Portuguese officials for Rand labor supply provides that 55 per cent of the Transvaal's traffic be sent through the port of Lourenco Marques and that labor contracts will be reduced over a period of five years to 80,000 men. Page 1070.

* * *

The Ophir and Dry Canyon districts in Utah are being extensively developed for silver-lead ore. Regular shipments are expected from the Kearsage Standard soon. Page 1069.

* * *

Durango citizens voted a gas franchise to Hope Engineering recently, which, it is expected, will result in erection of a new smelter at Durango to treat the complex ores of the San Juan basin. Page 1068.

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Mount Lyell has completed the construction of a 6,920-ft. tunnel to connect its North Lyell mine with the treatment plant at Queenstown, Tasmania. Page 1067.

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Federal M. & S. has bonded the Silver Bell in Butte County, Idaho. Page 1067.

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Bluford Balter has acquired an option on the Senator mine from the Phelps Dodge Corporation for the purpose of facilitating production in the adjoining Storm Cloud mine. Page 1068.

Research Shows Flotation Should Aid in Treatment of Michigan Copper Ores

WASHINGTON, D. C., JUNE 26, 1928. —Application of the flotation process to the treatment of the amygdaloid ores of the Michigan copper district promises to add materially to the recovery of copper there, it was announced today by the U. S. Bureau of Mines. Since January, an intensive program of research has been carried on under a cooperative agreement between the mine operators, the Michigan College of Mines and Technology and the U. S. Bureau of Mines.

It is reported that the representatives of these groups are agreed that a very important discovery has been made. Metallic copper of the amygdaloid ores had been considered to be too coarse to float. Earlier attempts along these lines gave negative results. Under the direction of A. W. Fahrenwald, ore dressing engineer on the staff of the Bureau of Mines, a method of flotation has been evolved, which, it is hoped, will add greatly to the recovery of copper from amygdaloid ores. In addition to the increased recovery, a lower slag loss in smelting and no table middling to regrind in the concentration plant are foreseen. As a result of the successful experiments conducted in recent weeks, the entire district is considering the question of undertaking the flotation of amygdaloid copper on a commercial scale.

Among the foremost producers in the Michigan district may be listed Calumet & Hecla Consolidated and its subsidiary, Isle Royale, Mohawk Mining, Quincy, Copper Range, and Champion Copper, all located in Houghton and Keweenaw Counties, Mich.

Treadwell-Yukon Mill Now Treating 225 Tons a Day

SINKING by hand at the No. 3 shaft of the Errington mine of Treadwell-Yukon in the Sudbury district has been going on for some time. Preparations are being made to reach the objective of 1,000 ft. as soon as possible. Concrete foundations for the power plant at the shaft have been set and the machinery is expected to arrive within a few weeks. No. 2 shaft has been completed and connected with No. 1 at the 300 level.

Despite disturbing rumors about trouble in separating the ores, an almost perfect recovery has been obtained from the new mill, it is reported. At present the plant is treating about 225 tons a day. One ball mill is operating and a second unit is being installed. As soon as the necessary crushing equipment is in operation, the tonnage will be increased to 500 tons a day.

Flin Flon Will Use Churchill River Power Site

HUDSON Bay Mining & Smelting, which owns the Flin Flon mine in northern Manitoba, has finally reached a decision as to the site from which it will obtain the power for operations at the mine, according to an announcement made on June 14 by Premier James Gardiner of the Province of Saskatchewan. The development will be at Island Falls, 15 miles west of the eastern boundary of Saskatchewan. It has been made a condition that one-sixth of all power developed shall be reserved for the public use in Saskatchewan.

The Island Falls site is 55 miles from Flin Flon. Estimates of power available are about 76,000 hp. at ordinary minimum, and 95,500 hp. at six months' flow. The company had been considering the use of a site on the Nelson which is 180 miles from the mine but which could develop more than double the power at Island Falls.

Writ of Mandamus Refused American Silver Producers

A WRIT of mandamus was refused the American Silver Producers Association by the Supreme Court of the District of Columbia on June 27 in connection with the suit to require the Secretary of the Treasury to complete the purchases of silver as prescribed by the Pittman act of 1918. The writ was refused on the ground that the association, the Della S Mining Company, and the Consolidated Mining Company are not parties at interest and have no authority to sue the government in the public interest. The case will be carried to the Court of Appeals by the mining interests involved.

Demand Transfer of Bureau of Mines to Department of Interior

Pending Departure of Hoover from Department of Commerce Renews Dissatisfaction With Present Arrangement—Bureau Will Standardize Contracts on Co-operative Research

By Paul Wooton
Special Washington Correspondent

KNOWLEDGE that Secretary Hoover soon will be leaving the Department of Commerce has had the effect of increasing the demand within the industry that the Bureau of Mines be returned to the Department of the Interior. At the time of its transfer to the Department of Commerce, the fear was expressed that the Bureau would suffer as a consequence. As long as Mr. Hoover, a mining engineer, was at the head of the department, the dissatisfaction with the change has not become articulate. A new bureau in a department finds conditions much the same as a new member in the House of Representatives—most of the prerogatives come from seniority. Even with the knowledge of Mr. Hoover's interest in bringing a bureau concerned with production in closer contact with agencies concerned with the distribution and sale of the output, many think that the Bureau has suffered by reason of its transplanting. In the Interior Department, it is argued, the Bureau would be closely affiliated with the Geological Survey, from which it sprang, and with a department dealing almost entirely with western problems. For that reason many believe that it now has been demonstrated that the Bureau of Mines in its old relationship was in a better position to serve the mining industry than it is now in a department where the older bureaus are likely to be favored in the matter of appropriations.

In an effort to provide a uniform contract covering co-operative agreements, which will be satisfactory to the appropriations committees and to the Bureau of the Budget, the Bureau of Mines has drawn up a standard form for such contracts. The co-operative agreements now in effect are not uniform and in most instances are vague and indefinite. They frequently have come in for criticism in the preparation of the budget. As it now is proposed to secure additional funds for research, to be expended co-operatively with the states, it is felt that the first necessary step is to put into effect a uniform agreement which will be satisfactory to the government agencies concerned.

It is realized that some of the agencies now co-operating with the Bureau will feel that the existing contracts have been satisfactory in the past and constitute all that is needed. Federal expenditures, however, are open to more scrutiny and are subject to more criticism than are state expenditures. More requirements must be met and more formalities observed. When that is understood it is believed there will be no objection by the states or the universities to enter into the standard contract which has been evolved by the Bureau.

The Bureau of the Budget has demanded itemized statements of the amounts contributed by the co-operating agency. To meet that requirement, a schedule of such contributions will be submitted at regular intervals. This will show the exact expenditures by the university, or other co-operating agency, for rent or equipment and the value of heat, light, power, water, and gas furnished, as well as the payments to personnel to be divided into technical, fellowship, clerical, custodial, and unskilled classifications. There will be an itemized list of supplies furnished, of travel expenses, and of the cost of publications.

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Bowonga Tin Fails to Discover Commercial Ore

The Bowonga tin field, in northeastern Victoria, Australia, which was the scene of a boom about a year ago, has not fulfilled any of the anticipations of sanguine promoters. Bowonga Tin Mining, which had been carrying out a program of systematic prospecting, has failed in its efforts to discover a commercial lode. The ore that was found was in patches and the inducements were not sufficient to warrant expenditure on mining and milling plants.

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Reopen Hastings Quicksilver Mine in California

H. L. Slosson, Jr., who recently acquired the Hastings property, four miles northeast of Vallejo, Calif., has formed the Hastings Quicksilver Mining Company to reopen the property. An air compressor is being installed as well as an Andrews quicksilver furnace of the rotary type. Some exploration work has been started. The power line is being extended to the mine.

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Park Bingham Company Sells Holdings in Park City

CHARLES MOORE, of Yuba City, Calif., on June 18 purchased the Park City, Utah, holdings of Park Bingham Mining for $125,000. A company will be formed to develop the property, operations beginning early in the fall.

Development already accomplished at the property consists of a 2,000-ft. tunnel and a 70-ft. winze sunk 300 ft. from the tunnel portal.

Investigate Witwatersrand Mucking Practice

IT IS generally admitted that the progress achieved in rock-breaking practice on the Witwatersand during recent years has been as remarkable as it has been satisfactory. But, although breaking efficiency has been improved, it is contended that "lashing" or mucking practice has not yet kept pace. A suggestion has been made that more mechanical lashers and efficient labor could be employed. The increasing black labor requirements of the mines, coupled with the threat of restriction of East Coast supplies by the Portuguese, have caused mine managements to investigate not only the quantities of labor available but the quality as well.

Every effort is being made to increase mine "boy" efficiency, and the worker is being schooled in the elementary principles of his work. The wrong posture or the most laborious method of handling tools, although small things in themselves, assume huge dimensions in the form of waste when they are used by a considerable proportion of the 200,000 natives employed on the Rand.

On the Crown Mines, at No. 5 shaft head, a small native practical training school has been put to a useful purpose for a considerable time. Other similar training schools at various points along the Reef are now contemplated.

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Potash Discovered in New Brunswick, Canada

ACCORDING to an announcement by the Canadian Department of Mines, potash salts have been discovered in a thick bed of rock salt recently bored in search for oil and gas at Gautreau, Westmoreland County, New Brunswick. Drilling operations conducted by the D'Arcy Exploration Company on behalf of New Brunswick Gas & Oil Fields, Ltd., at 1,295 ft. from the surface entered a bed of rock salt 485 ft. thick. Samples selected for analysis in the laboratories of the Department of Mines at Ottawa have been found to contain a varying percentage of potassium. This element is present in each sample tested.

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Lake Superior Institute to Meet on Menominee Range

The annual meeting of the Lake Superior Mining Institute will be held on the Menominee iron range in upper Michigan Sept. 7 and 8. Mining engineers, superintendents and their assistants will convene in Iron River and Crystal Falls, Mich., Sept. 7. The following day they will go to Iron Mountain, where the convention will be held. George Eisele, assistant superintendent of the Oliver Iron Mining Co. on the Menominee range, is general chairman of the committee on arrangements. Engineers and mining officials of national reputation will speak at the convention. The meeting will be the first the institute has held for two years.

Twin Peaks Will Start Operating About Aug. 1

Ten-Stamp 50-Ton Mill to Treat Gold Ore—Mine Developed by Several Shafts and Two Tunnels

MINING and milling operations are to start Aug. 1 at the property of Twin Peaks Mining, situated 13 miles east of Wilcox, Ariz., in the Dos Cabezos district of Cochise County, according to William F. Hayden, of Salt Lake City, consulting engineer for the company.

Twenty-one claims, totaling over 400 acres, comprise the property. The ore contains gold and silver, with the gold predominating. Development, consisting of several shafts and two crosscut tunnels, indicates the presence of extensive orebodies to a depth of 550 ft. The two tunnels are 250 ft. apart, and are known as the Dives and Baldwin No. 1 tunnels, the former being 900 ft. in length, and the latter 1,100 ft. Quartz outcrops on the property have been encountered at depth in the course of development for a distance of 6,000 ft. and over a width varying from 20 to 60 ft. Mill heads, during a series of recent test runs, ranged from $8 to $20 a ton of ore treated. Past production from the mine is estimated at $500,000.

A 50-ton ten-stamp mill on the property has been thoroughly overhauled and put in condition for efficient operation. Following further tests on the ore, the company plans to add a flotation plant, and later to erect a 300-ton mill. A crew of 14 to 18 men will be employed at the start, this force being increased as development of the property proceeds. Operations will be in charge of George Reynolds, superintendent.

Mechanical equipment at the property includes a large Fairbanks-Morse hoist, driven by a V-type Diesel engine; 300 cu.ft. Chicago Pneumatic air compressor; well stocked blacksmith and machine shop; and an adequate number of mine cars, rock drills, and other mining supplies. All buildings and machinery are in good repair, and no difficulty is expected in placing, and in keeping, the property on an operating basis.

Ore and concentrates will be shipped over the extension of the Mascot and Western Railroad, owned by the Central Copper interests in the district. This line is less than a mile from the Twin Peaks property, and joins the town of Dos Cabezos with Wilcox, which is on the Southern Pacific Railroad.

Officers of the re-organized Twin Peaks Mining Company, all of whom reside in Los Angeles, Calif., are George E. Sanders, president; Walter P. Dresser, vice-president; and Luther H. Baldwin, secretary and treasurer. The offices of the company are at 231 Rives-Strong Building, Los Angeles, Calif.

Mill at the Twin Peaks property in Dos Cabezos district.

Two U. S. Mining Engineers Kidnapped in Mexico

The Department of State at Washington, D. C., has received a telegram from Edward P. Lowry, United States consul at Guadalajara, to the effect that W. H. Mitchell and John F. Hooper, American mining engineers at the Mezquital del Oro mines in Zacatecas, had been kidnapped at ten o'clock on the morning of June 22 by rebels at Rio Blanco, 15 miles north of Guadalajara, while en route to Mezquital del Oro. The consul adds that their chauffeur returned with a note saying that the rebels wanted 18,000 pesos and "we're all right but do not know for how long." Mr. Lowry adds that he advised military headquarters immediately and the latter claim that troops are in pursuit.

The American Chargé d'Affaires at Mexico City, Arthur Schoenfeld, has asked the Mexican government to take appropriate and energetic measures to obtain the safe release of Mitchell and Hooper.

Rooney Gold Starts Work

Mining operations have been started at the Rooney Gold Mines tract, consisting of more than 600 acres in Spotsylvania County, Va., which was recently acquired by G. Z Falconer of Lexington, Ky. A crosscut to explore the main ore-bearing formation has been started under the direction of Marshall Haney, mining engineer of Geer, Va. The property adjoins the famous Whitehall mine, which produced $18,000,000 in gold before the Civil War, according to records filed at the U. S. Mint.

Federal Bonds Silver Bell in Butte County, Idaho

Lawrence Mine at Clark Fork Is Being Opened—New Jersey Consolidated to Work Coeur d'Alene Claims

FEDERAL Mining & Smelting of Wallace, Idaho, has taken a bond on the Silver Bell property, located in the Lava Creek district, Butte County, Idaho. The property consists of twelve claims on which considerable development has been done. Last February a carload of ore was shipped to the Murray, Utah, plant of American Smelting & Refining which is said to have netted $50 a ton, carrying 47 per cent lead and 48 oz. in silver per ton. The Federal company is installing a compressor and other equipment in preparation for an extensive development campaign.

American Canadian Engineering is the name of a company that has been organized to purchase the Lawrence mine at Clark Fork, Idaho. According to W. W. Philbrick of Spokane, president of the new company, the 50-ton mill on the claims will be started up by the middle of July. Development of the silver-lead ore has been started already. The Lawrence holdings total 212 acres.

The Stratton interests, which control several other Coeur d'Alene properties, have formed New Jersey Consolidated to take over a number of claims in the district. In addition to the New Jersey property on Elk Creek, the new company will operate the King of Pine Creek, which adjoins the Lookout Mountain mine that recently started producing; the High Grade on Elk Creek; the Eleventh Hour group; and the Kimball claims in the North Fork section. The plans formulated by the New Jersey company center for the present about the King of Pine Creek claims. It is planned to sink the shaft to 200 ft. in the belief that the vein will prove to be a continuation of the Lookout Mountain orebody.

7,000-Ft. Tunnel Is Completed at Mount Lyell

ON MAY 25, the 6,920-ft. tunnel, which Mount Lyell Mining & Railway has been constructing to connect the 1,100 level of the North Lyell mine with the treatment works of the company at Queenstown, Tasmania, was holed through. The work took fourteen months, and the company had three shifts of men employed in driving the tunnel, which measures 9x9 ft., and has a grade of 1 ft. to 200 ft. The tunnel will not be used at present as it has to be equipped. The main object in constructing it was to eliminate the present circuitous route for the transportation of the ore across the range between the mine and works. Additional advantages will accrue in that the haulage of the ore from the 1,100 level to the surface will be eliminated and the cost of pumping considerably reduced. A page of illustrations featuring the operations of the Mount Lyell company will be found on p. 1044.

Gas Franchise May Mean New Smelter for Durango

Several Mills Being Built in Silverton Area—Hidden Treasure Mine Purchased by J. A. Gould

HOPE Engineering & Supply Company of Mount Vernon, Ohio, was awarded a 25-year franchise to supply the city of Durango, Colo., with natural gas at a special election on June 12. It is generally believed that as a result of this move, a new and improved smelter will be built at Durango to serve the San Juan Basin mines. Lead and zinc are the principal metals produced in the district, although quantities of gold and silver are also recovered.

The Hope company will obtain its supply of gas from four wells on the Ute reservation in New Mexico, about 35 miles southwest of Durango. It is expected that local consumption will not exceed 30,000,000 cu.ft. of the estimated daily flow of 236,000,000 cu.ft.

Within the last few months several of the old Silverton properties, in the San Juan district, have been reopened. Mill building forms part of the program of most of the operating companies. At the Lackawanna group, the cement foundation for a flotation plant has been laid and work on the superstructure is expected to begin immediately. The capacity of the mill will be 100 tons daily. Machinery has already been purchased and it is hoped to start operations about the middle of August. Louis Bastain is supervising the mill construction.

At Sunnyside Mining & Milling, which is controlled by U. S. Smelting, Refining & Mining, a new electric hoist is being installed. When the installation is completed, it is expected that the capacity of the mill will be stepped up to 1,200 tons of zinc-lead-silver ore a day, as the necessary additions to mill equipment are being made.

Shenandoah-Dives Syndicate, which owns the Shenandoah-Dives, North Star and Mayflower groups, is remodeling the Iowa-Tiger mill, located about 3 miles from Silverton. The plant will treat about 100 tons of silver-lead-gold ore by flotation methods. Charles A. Chase is manager of the company.

J. A. Gould of New York, who has been operating the California group of mines in the Lake City district, has purchased the adjoining Hidden Treasure mine for a consideration said to be $250,000. The property was formerly owned by Thomas F. Walsh, who sold the Camp Bird mine to F. W. Baker and John Hays Hammond for $5,000,000. The Hidden Treasure carries silver-lead-zinc ore. There is a 100-ton mill on the property, but a more up-to-date plant will be built to handle ore from all of the Gould properties.

Repair Work in Quincy No. 2 Shaft Down to 47 Level

AT QUINCY, in the Michigan copper district, the worst of the damage caused by fire in No. 2 shaft has been repaired and this work should now proceed at a more rapid rate. Repairs have reached a point below the 47 level. The fire started at the 53. No. 8 shaft has been reconditioned, affording a connection with Nos. 2 and 6. No. 8 will be opened both laterally and at depth. It has approximately 1,000 ft. to go before it reaches a depth corresponding with the deepest levels in the other two shafts. In No. 6 there is no change in the heavy copper content of the main vein in the north drift in the 87 or bottom level. This opening is in over 400 ft. Meanwhile, sinking is proceeding, approaching the 88 level. The Pewabic bed with its series of lodes has steadily lengthened at depth, giving Quincy a greater vein area with each new level. Thus the drift to the north in the 87 has more than 7,000 ft. to go and the south drift upwards of 4,000. The caving within the last year of stope pillars generally in the old worked out portions of the mine has, it is believed, left the mine in a safe physical condition.

ERRATUM — On page 1034 of this issue it is stated that a publication called *Underground* recently "appeared and disappeared." Information just to hand indicates it is still being published.

Three Advisory Committees Hold First Meetings

SUGGESTIONS that should be of value in conducting the research work in progress at the Intermountain Station of the U. S. Bureau of Mines and by the department of mining and metallurgical research of the University of Utah were submitted at three meetings of special advisory committees composed of leading technicians of the Salt Lake district that were held recently at the Intermountain Station.

The committee on grinding reported that little information was available on the fundamentals of grinding, and suggested that, by all means, the Bureau's proposed grinding investigation should be continued.

After some discussion, the committee on microscopic examination of ores agreed upon the following points as a basis of preliminary work: (1) That microscopic work in determining the minerals present in various ores, and their association in the ores, is of vital importance as the first step in working out a plan of selective flotation; (2) that the work done in past years by R. E. Head has been of great assistance to many mining companies, but that the scope of such work could be greatly increased; (3) that the examination of minerals and the interpretation of results can be done only by one who has had wide experience, and for this reason it is not desirable or economical for each company to maintain a microscopic laboratory with a competent man in charge; (4) it is, therefore, suggested to the companies interested in such work that all microscopic work be done under the supervision of R. E. Head at the Bureau of Mines station, and that the companies assume a portion of the expense in connection with the enlargement and operation of such a co-operative laboratory.

At the meeting of the committee on flotation, the pure mineral program was endorsed with the suggestion that more attention should be given to gangues and slimes.

Senator Mine, Near Prescott, Optioned From Phelps Dodge

THE OLD Senator mine, in the Hassayampa district, Yavapai County, Ariz., formerly operated by Commercial Mining and owned for many years by Phelps Dodge is under option to Bluford Balter, present operator of the adjoining Storm Cloud mine. Present workings at the Senator include a shaft, several drifts, and a 3,600-ft. tunnel which cuts almost under the Storm Cloud. The Senator was obtained largely for the purpose of providing cheap mining and underground haulage for several veins of complex ore that are said to have been struck in the Storm Cloud workings. These veins contain gold, silver, lead, copper, and zinc. The Storm Cloud mill is being increased from a 50- to a 100-ton capacity plant and it is stated that this may eventually be increased to 300 tons.

About 80 men are being employed by the Phelps Dodge company in the Greaterville district, near the Santa Cruz-Pima road, under the direction of Percy Williams. Shipments from the property are being made to Sonoita, Santa Cruz County. The Greaterville district enjoyed an enviable reputation as a placer camp during early Arizona days. Geologists and engineers estimate that a large tonnage of gold ore still remains which can be developed economically when sufficient water is made available.

Will Prospect for Lead-Zinc Ore in North Carolina

Lanfear Norrie, of New York, it is reported, has taken an option on a 920-acre lead-zinc prospect near Lexington, N. C. The tract is in the Silver Valley mining district, where ore was produced thirty years ago and shipped to Thomasville for smelting. Besides zinc and lead the ore contains silver and gold. Inability to separate the lead and zinc sulphides was one of the obstacles to successful operation, but it is hoped that this can now be overcome with flotation methods. The district is the only one in North Carolina where ore of this character is found, the Silver Hill mine on which a 650-ft. shaft was sunk, being the best known in the area. It is planned to unwater the shafts and carefully sample the workings.

General view of the Dry Canyon district, Utah

Lead-Silver Mines Developing in Ophir and Dry Canyons

CONSIDERABLE attention is being directed toward the revival of mining in the Ophir-Dry Canyon district, situated in the Oquirrh Mountains about 60 miles south of Salt Lake City. Though renewed activity in the area dates back several years, only within the last few months have they been of sufficient importance to indicate the possibility that the district will again become a producing camp.

One of the largest enterprises in the section is that of Ophir Mono Mines, which has acquired control of 1,500 acres in the northern part of Dry Canyon. This company is actively developing its holdings, and has recently encountered ore at several points. A crew of twelve men is employed, and adequate equipment, including a ten-drill compressor, is on the property. The company is financed by Detroit capital, and operations are under the direction of M. C. Godbe, manager. C. T. Van Winkle acts as consulting mining engineer and geologist to the company.

Kearsarge Standard Mining, operating on Shoo Fly Hill, recently made a shipment of high-grade lead-silver ore, containing some copper and gold. Since then the majority of the operating force has been engaged in building ore bins preparatory to beginning regular shipments. Sixty tons of ore is now in the bins, and a steady output is expected. Production followed the recent discovery of new fissure deposits, 250 ft. from the portal of the Fortune tunnel. Sixteen men are now employed, and three rock drills are being operated. During the last month the main tunnel was advanced 90 ft.

Throughout the last year the Ophir Hill Consolidated Mining Company—one of the Clark interests—has been prospecting on the west side of Ophir Canyon with the object of intersecting the continuation of the orebody formerly mined on the opposite side of the canyon. From a short tunnel into the west mountainside, a 1,400-ft. three-compartment shaft has been sunk. This shaft is timbered for the full depth, and is equipped with an electric hoist. Crosscutting from the 1,340 level had been going on steadily for several months until recently, when a heavy flow of water was encountered. Operations are in charge of H. M. Hartmann, general manager of the company.

Surface buildings at the Kearsage Standard mine

Alvarez Mill to Start Soon—San Jose Is Being Explored

THE NEW flotation plant which Southwestern Engineering is constructing for Alvarez Mining at Ixtlan, Nayarit, is expected to be in operation by July 15 for the treatment of silver-lead ore. Mill equipment is being transported to the mine by mule-back from the nearest shipping point on the Southern Pacific of Mexico. The new plant is to have capacity for treating 40 tons of ore daily. The Alvarez company took over 50 acres in 1925 and has an option and lease on 215 acres belonging to Humboldt Mining, which adjoin the mines. Originally the property was worked by Spaniards. The ore is a sulphide carrying sphalerite, chalcopyrite, and pyrite.

Exploration work is being pushed at the Jesus Maria y Anexas mine at San Jose de Gracia, Sinaloa. This property, now controlled by Los Angeles, Calif., interests, was formerly the property of the Anglo-American Corporation and had a production record of more than $25,000,000 before being closed down in the revolution of 1917. The mineralization is chiefly in gold.

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B. C. Department of Mines Confirms Squaw Creek Find

IN REGARD to the recent placer discovery at Squaw Creek, erroneously reported to have been in Yukon Territory, the British Columbia Department of Mines has made the following statements. The situation of the new field is in British Columbia, close to the Yukon boundary, and it has caused considerable excitement at Atlin, B. C., and White Horse, Y. T. The gold commissioner at Atlin, C. L. Munroe, has telegraphed the department that information received from Mrs. Muncaster, owner of a ranch at Dalton Post, Yukon, is that Indians were taking $60 to $80 daily from the discovery by the crudest methods. All the gold recovered by them is coarse. The largest nugget is valued at $32. The discovery was made by the Indians late in last fall, but could not be worked until the spring. In a communication to the department at that time, Mrs. Muncaster stated that she had advised the Indians to elect her a deputy recorder, in accordance with provision 130 of the Placer Mining Act of British Columbia, which they did. They then staked their claims and she recorded them at the office of the mining recorder in Atlin.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Smelter Unit Will Be Built by International Nickel at Copper Cliff

TORONTO, JUNE 23, 1928.—International Nickel has completed arrangements for the construction of a new smelter unit at Copper Cliff, Ont., to be used in the treatment of ores from the Frood mine. Part of the work will be done by the company and the balance by Fraser Brace Company. Ground will be broken some time in the fall. The schedule calls for the completion of the smelter before the mine is brought into production, so that it will be finished some time in 1930. Eventually the company proposes to move part of the Port Colborne refinery to Copper Cliff. When this is completed, nickel and copper will be separated at Copper Cliff and blister copper produced, nickel being sent to Port Colborne for treatment. During the present year the company will start the construction of two new electrolytic units at Port Colborne, and eventually all nickel will be produced electrolytically, permitting the recovery of almost all precious metal contents in the ore.

MILL heads at the Lake Shore mine in the Kirkland Lake district, have been running high and during a number of days this month, recovery has been at the rate of $30,000 a day. It is expected that production for the last quarter of the company's fiscal year will be more than $1,000,000. The mill is handling about 950 tons a day, a new high tonnage record. Sinking in the new shaft is now down more than 900 ft., it is reported.

The first diamond-drill hole on the 975 level of the Noranda mine in the Rouyn district, where interesting discoveries have recently been made, showed 46 ft. of ore in a length of 86 ft. The first 20 ft. drilled, showed an average of about 20 per cent copper and $1.50 in gold. A station is being cut at the 850 level, and the orebody should be opened up soon at that point. Arrangements have finally been completed with the government of Quebec to permit the extension of the Nipissing Central railroad to the Noranda property. This will involve laying about one mile of track, and the work should be completed early in July.

Assay reports recently made on the first carload of copper ore shipped to the Noranda smelter from the Amity mine near Boston Creek, Ont., gave an average of 13½ per cent copper for 26½ tons of ore.

F. M. Connell and associates, who control the new discoveries in the Favorable Lake section, northwest of Red Lake, have formed a company known as Favorable Lake Mining & Exploration Company, Ltd., to take over the Murray claims on which the original discovery was made. The company is issuing 1,000,000 shares of stock of a par value of $1. A contract has already been let for diamond drilling on the property.

The latest hole drilled at the Sudbury Basin Mines shows 54 ft. of ore of which 30 ft. is high grade. The ore is in three sections—27, 17, and 10 ft. in width—with lower grade material between. This company has now completed seven holes over a length of 3,000 ft., all of which struck ore of commercial grade, 10 to 54 ft. wide.

Johannesburg Letter

BY OWEN LETCHER
Special Correspondent

Plan for Rand Labor Supply Provides for Use of Portuguese Port

JOHANNESBURG, MAY 23, 1928.—The Minister of Railways for South Africa, C. W. Malan, went to Lisbon to negotiate an agreement regarding the native labor supply for the Rand mines and the division of traffic between Lourenco Marques and other South African ports. The draft agreement on the basis of a new convention provides that the Portuguese receive 50 to 55 per cent of the traffic of the Transvaal and in return makes drastic stipulations in the supply of labor. The number is to be reduced in five equal proportions over five years to a maximum of 80,000—a reduction of 25,000. Labor contracts will be for twelve months, and in any case may not exceed eighteen. For the last three months of the twelve-month contract, half the laborer's wages shall be paid in Mozambique, and if the contract is for eighteen months, half wages shall be so deferred for nine. The agreement is for ten years. The draft of the Mozambique convention has been signed.

DURING the current year, the Transvaal Consolidated Land and Investment Company has purchased the freehold and mineral rights over certain portions of the farm Brakspruit No. 393, which is about 1,400 acres in extent, and the adjoining farm Hoedspruit No. 224, which includes about 850 acres. An incline shaft is now being sunk on the Brakspruit claims to test the platinum values of the reef at depth and to make bulk samples of it available for experimental treatment. The investigations are being carried out by the consulting metallurgists of the Rand Mines, Ltd. Considerable progress has already been effected through the successful application of flotation processes to these ores and the problem of extracting platinum economically in marketable form from the flotation concentrates is now being considered.

London Letter

BY W. A. DOMAN
Special Correspondent

African Asbestos Deposits Attract Attention of London Market

LONDON, JUNE 12, 1928.—A new branch of the mining industry to receive attention in Africa is the asbestos industry. "A certain liveliness" in asbestos shares is noticeable on the Stock Exchange. The latest company to be formed is the African Asbestos Trust, which has acquired about 8,000 acres of ground at Kalkkloof, 30 miles east of Carolina, Cape Province. W. H. F. Dudgeon reports that a number of asbestos-bearing lodes have been located already, and that about 1,000,000 tons of fiber-bearing rock can apparently be obtained from the eastern section, containing 60,000 tons of fiber.

Sungei Kinta Tin Dredging, operating in the Federated Malay States, is increasing its output. Last year difficulty was found in dredging because of decomposed timber that choked up the pumps. William Simons & Company has built a new dredge for the company, and the manager is thoroughly satisfied with it. It is a most efficient machine, fitted with jigs instead of ordinary sluices.

R. B. WOAKES recently estimated that the Indian Copper Corporation, which owns properties in the Singhbhum district of Bengal, India, has a probable reserve of 220,000 tons averaging more than 3 per cent copper in addition to proven reserves of 624,539 short tons, averaging 3.85 per cent copper. Mr. Woakes is consulting engineer of the corporation.

The Caminha tin area of about 3,000 acres at Vianna, Portugal, has been acquired by the Abbaye Development Company, Ltd. The same company has also acquired some claims in Nigeria which have been favorably reported on by Messrs. Rumbold, Hill, and Stewart.

The pursuit of economy in working the Rand mines has drawn attention to some of the Kaffir shares again. A few, such as New Modderfontein and Geduld, are being bought for investment. There is an overflow of interest into the base metal market. At the moment both tin and copper are favored. A good deal is being said of the part Minerals Separation, Ltd., is playing in the development of copper properties and much is hoped from an extension of the company's activities, although it has had some troubles in Rhodesia.

In Spain another property is to be examined with a view to tin production. The property is owned by Jepson (Metals), Ltd., and is situated about eight miles east of Cartagena. It has been worked for several years for lead and iron, but only recently has tin been seriously considered.

Societies, Addresses, Reports

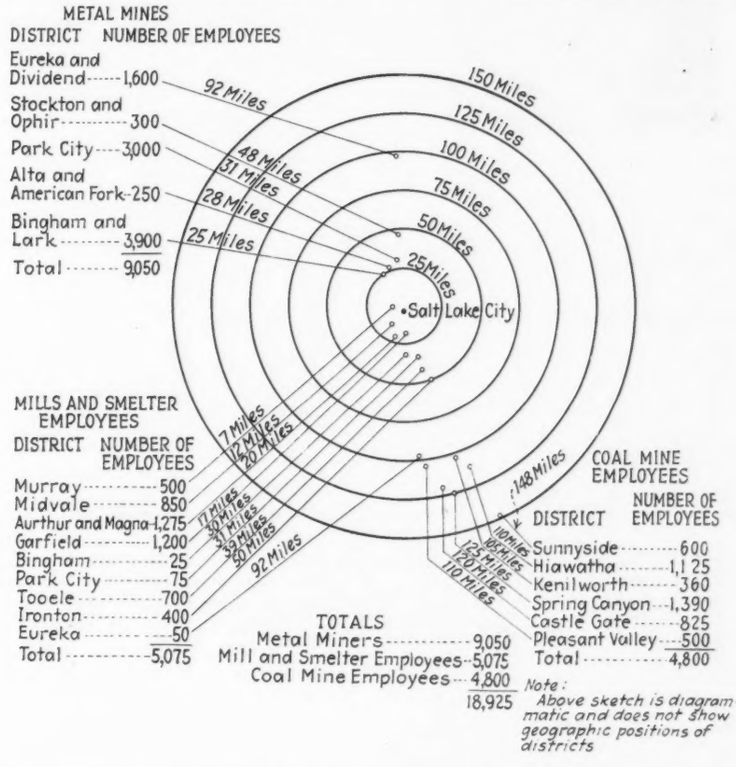
Bureau of Mines Establishes Safety Station at Salt Lake

IN PASSING the second deficiency bill recently, Congress approved an appropriation of $18,500 for the establishment of a safety station at the Intermountain Station of the U. S. Bureau of Mines situated at the University of Utah, Salt Lake City. The appropriation covers, besides complete necessary safety equipment, the services of a district mining engineer, foreman miner, and first-aid miner. Dr. Arthur L. Murray, district surgeon of the Bureau, will be in charge of the safety work at the station, besides having direction of Mine Rescue Car No. 9 of the Bureau, which serves Utah, Idaho, Montana, and the eastern half of Nevada.

The new safety station will fill a long felt need. Within a radius of 150 miles of Salt Lake City, over 18,000 men are employed in the mining industry, as shown in the accompanying sketch. Besides these, the numerous smaller allied industries in the district, such as, foundries and cement plants, employ a large number of men. Courses of instruction and the services of the safety station will be available to all these workers and industries; a truck completely equipped with first-aid supplies and mine rescue apparatus will be in constant readiness to answer emergency calls in the district. Moreover, the curriculum of the department of mining and metallurgy at the University of Utah will include, as a required course, first-aid and mine rescue instruction, supplemented by additional instruction in industrial hygiene as applied to the field of mining and metallurgy. These courses will be given by Dr. Murray and his staff.

Headquarters of the safety station will be situated in the new mines building, nearing completion on the north side of the campus. When fully equipped the station will be one of the principal safety stations of the Bureau. Space in the new building allotted to the station includes four rooms on the ground floor, and three on the floor above. A thoroughly-equipped instruction and demonstration room, an apparatus and bench room, smoke room, and garage will occupy the ground floor space; that on the floor above will be used for a chemical analytical laboratory, and offices for the district surgeon and district mining engineer.

It is planned to equip the station with all the necessary safety supplies and appliances, such as, self-contained breathing apparatus, carbon monoxide detectors, pyrotannic acid outfits for carbon monoxide determinations in blood and air, methane detectors, canaries, self rescue apparatus for protection against carbon monoxide, oxygen inhalers, Orsat gas analysis apparatus, and complete supplies for giving instruction in the Bureau's approved course in first-aid.



Good Records Obtained in Phelps Dodge Safety Work

EXCELLENT records for the month of May were obtained in the safety campaign of the Phelps Dodge Corporation. The Morenci branch led the roll, establishing a perfect record by working the entire month without a lost-time accident in any department. Copper Queen jumped from fourth to second place, by recording only one lost time accident in all departments—the first time such a record has ever been made by Copper Queen. The one accident was in the smelting department. Moctezuma Copper dropped from first to fourth place, with five accidents in the mining department, while the Old Dominion in Globe, preceded it in third place, with only two lost-time accidents, also in the mining department.

Based on an accident rate for 1,000 shifts, Copper Queen branch had a mark of .015 for May, while that of Old Dominion was .093 and that of the Moctezuma Copper .094. Morenci has established a remarkable record for the year to date, recording only six lost time accidents for the first five months of 1928. The Moctezuma branch had 13; Old Dominion 10, and Copper Queen 45. Many of the latter were in the smelting department at Douglas. Figured on the basis of 1,000 shifts worked, the record of the Morenci branch for the year to date is .037; the Copper Queen .131; the Old Dominion .095; and Moctezuma Copper .049—all showing a minimum of accidents compared to the large number of men employed.

Ontario Mining Association Holds Annual Meeting

ANNUAL meeting of the Ontario Mining Association was held in Temagami June 14, 15 and 16. Those in attendance consisted of the managers or representatives of the various mining companies of northern Ontario. Two matters in which the members were particularly concerned are accident and silicosis compensation. V. A. Sinclair, chairman of the Workmen's Compensation Board of Ontario, was present at the meeting to discuss these matters.

Arrangements are being made to have all men examined for silicosis, by doctors to be employed by the Workmen's Compensation Board. Assessments for silicosis to date amount to about $447,000, but it was pointed out that the compensation board, up to the present time, had been dealing with the accumulation of the last 15 or 20 years and that, once the situation had been cleaned up, the expenses involved should be much less. At the business meeting, J. Y. Murdoch, president of the Noranda Mines and a director of Sylvanite and Wright-Hargreaves, was elected president of the association. The executive committee consists of the following—J. Y. Murdoch, J. P. Bickell, C. D. Kaeding, J. P. Watson and Fraser Reid. G. C. Bateman was re-elected secretary-treasurer.

Personal Notes

L. W. STRAUSS returned to his headquarters at Kirkland Lake on June 28 after a visit of a week to New York City.

B. PARKER HOWELL, of Reno, Nev., is directing the operations of the McCoy-Nevada Gold Mines, at Battle Mountain, Nev.

H. H. KNOX and Mrs. Knox left New York on June 20 on their way to Queensland, Australia, by way of San Francisco.

G. A. JOSLIN is examining several properties near Guanajuato, Mexico. He expects to return to Los Angeles early in July.

A. S. HOWE, of Sutter Creek, Calif., recently addressed the Sacramento Chamber of Mines on the subject of mine taxation.

C. J. BARBER, of the engineering staff of the Mexican Corporation at Fresnillo, Zacatecas, Mexico, has left Mexico for England.

CHARLES A. MITKE has not returned to Arizona from London, as previously mentioned in *E. & M. J.*, but is still in New York City.

I. J. A. DIAMOND, mining engineer of Johannesburg, is examining chrome deposits in the Salisbury district of Southern Rhodesia.

F. M. MANSON, president of Consolidated Cortez Silver of Cortez, Nev., has gone to Texas where he will inspect several cinnabar properties.

J. PARKE CHANNING is on his way to New York from California. He is making the journey by automobile and is expected to arrive about July 4.

S. E. STEIN, metallurgical engineer with the Southwestern Engineering Corporation, recently visited the mining camps of northern Ontario and Quebec.

PAUL BILLINGSLEY, consulting mining geologist has returned to his headquarters in Salt Lake City following a month's trip through the Southwest and Mexico.

T. A. RICKARD has been in New York for several days after a trip from the coast by way of the Panama Canal. He will rejoin his family in British Columbia shortly.

R. J. WHITE and NORMAN WHITE are in Colorado inspecting mines there. They expect to visit Mexico before returning to their headquarters at Wallace, Idaho.

N. H. JENSEN, of the geological department of International Smelting, has returned to his Salt Lake City headquarters from a month's trip to the Southwest and Mexico.

ERIC J. SCHRADER, consulting mining engineer of Reno, Nev., has recently assumed the management of the Gold Circle Consolidated Mining Company, operating near Elko, Nev.

H. J. CAIN, general superintendent of Pioneer Gold Mines, is in charge of the work at the mine near Bridge River, British Columbia, in the absence of DAVID SLOAN, general manager, who is in Europe.

Dr. C. V. CORLESS has become general consultant to Mond Nickel. This change has resulted in the appointment

C. V. CORLESS

of OLIVER HALL, mines manager, as general manager of Canadian operations. The change will become effective on Aug. 1, 1928.

W. A. HOOTEN has been appointed engineer in charge of operations at Siscoe Gold Mines, in the Rouyn district. Mr. Hooten has been connected with Southwestern Engineering for a number of years.

M. H. MERRISS, metallurgical engineer of New York, has joined the staff of the brokerage firm of Dunscombe & Company, members of the New York Stock Exchange, located at 71 Broadway, New York City.

J. C. BRUMBLAY, field representative of Mason Valley Mines at the Thompson smelter, at Mason, Nev., left recently for Chicago. Mr. Brumblay intends to visit Salt Lake City and Denver before returning to Mason.

WALTER FITCH, president of the Chief Consolidated Mining Company, who arrived in New York on June 5 from a three months' trip to Europe, returned to the Eureka, Utah, headquarters of the company on June 13.

A. H. HUBBELL, associate editor of *Engineering & Mining Journal*, returned to New York on June 26. Mr. Hubbell made a trip through the mining districts of Sudbury, Porcupine, Kirkland Lake and Rouyn in Ontario and Quebec.

Dr. C. A. HEILAND, professor of geophysics at the Colorado School of Mines at Golden, Colo., is making a trip through Mexico and California. He has delivered lectures on geophysical prospecting in Los Angeles and San Francisco.

HERMAN FESING of Houghton, Mich., has been appointed to succeed George S. Goodale as superintendent of the Mayflower-Old Colony mines in the Michigan copper district. Mr. Goodale resigned recently to accept a position with Royal Tiger Mines in Colorado.

J. M. CALLOW sailed for London on the "Berengaria" on June 27. He will be gone a month or six weeks, the purpose of his visit being to initiate work on the drawing of plans for a concentrator in Australia. His client is a prominent British mining company.

FRED SEARLS, vice-president of Newmont Mining, HENRY KRUMB, and HAROLD S. MUNROE, of the advisory board of the company, are in Jerome, Ariz., in connection with the option which Newmont holds over the properties of United Verde Extension.

GEORGE ROSS BANCROFT, for many years a member of the engineering staff of Tonopah Mining, has been elected director and appointed consulting engineer of the Dominion Metals Investment Company, Ltd., of British Columbia, with headquarters in Vancouver.

H. C. JENNINGS, formerly with the U. S. Smelting, Refining & Mining Company, has accepted a position on the engineering staff of the General Engineering Company. Mr. Jennings' headquarters are at the Winnipeg, Canada, offices of General Engineering.

E. M. SPIEKER, associate professor of geology at Ohio State University, and formerly a member of the U. S. Geological Survey, has been in Utah for several weeks making a geologic study of portions of Carbon County. Mr. Spieker's study is being made in cooperation with the U. S. Geological Survey.

DR. R. R. SAYERS, chief of the Health and Safety Branch, and chief surgeon, of the U. S. Bureau of Mines, visited the Intermountain Station of the Bureau during June 18-21 to discuss plans in connection with the establishment of a safety station there. On leaving Salt Lake, Dr. Sayers proceeded to the Tri-State district, where he inspected the Bureau's clinic at Picher, Okla.

OBITUARY

CHARLES BRENT, mine manager of the Ontario Champion Mines in the Lake of the Woods district, Ont., died in Toronto on June 17.

MAJOR WALTER LAWSON, mining engineer, who was taking a special course in aviation with the Canadian Western Airways, at Winnipeg, Canada, was killed on June 16 when his plane crashed to the ground. Major Lawson was completing a qualifying course in aviation to enable him to fly to the mining districts of the north.

MARKET AND FINANCIAL NEWS

Important German Industrial Combine Is Reported

By Dr. James Rubinfeld
Special Berlin Correspondent

THE long-looked-for amalgamation of the two most important metal concerns of Germany, the Metallgesellschaft of Frankfort-on-Main and the Metallbank, is to be consummated. The merger will take the firm-name of the "Metallgesellschaft A.G." and will have a capital of 65 million marks of common and 5,860,000 marks of preferred shares, the latter divided into 4,000,000 of 7½ per cent, 1,060,000 of 6 per cent and 800,000 of 5 per cent shares. It might seem that metal trading objects are the chief fillip to this merger, as the fact that the Metallbank and Metallurgische Gesellschaft is chiefly an industrial undertaking, being engaged in many important metallurgical and chemical enterprises, whereas the Metallgesellschaft is known, primarily as a trading concern, as is Aron Hirsch Company of Halberstadt and Beer, Sondheimer & Company of Frankfort-on-Main. But in truth the personal bond is the presidency of Dr. Alfred Merton on one side and the co-ordination of mutual interests on the other, particularly since in recent years the same connections have been made in England, the United States, and Belgium. By this merger the research work and laboratory practice of the Metallbank and the alert commercial ability of the Metallgesellschaft have been combined, which, in the opinion of close followers of the situation, is only the precursor of similar events that will take place in the near future. Of course the demarcation line between research and commerce is somewhat fluid in an active country like Germany.

This reminds one of the increasing part which the new merger is to play in the renewal of the Silesian zinc industry, the German part of which, as is common knowledge, now belongs mostly to Poland. The output of zinc ores in German Upper Silesia is increasing, decidedly, since the development of the Bleyscharley mine of the Giesche concern. Average monthly outputs in the four years beginning with 1925 have been as follows (in thousands of tons): 6.5, 8.2, 8.9 and 10.8. The German parent firm, Giesche's Erben at Breslau, owns only 49 per cent of the capital of the Polish Giesche Spolka Akcijna, the remaining 51 per cent belonging to Anaconda Copper. The Giesche electric plant and mines are now being largely modernized on the American model. It is not to this alone that the fact that the production of Polish Silesian zinc mines has been more than doubled since 1913 must be ascribed, but also to the rapid strides made by the Silesian Mines and Smelters of Lipine, which is now the largest zinc producer of Polish Upper Silesia, since it has added (by acquisition of ownership with the French-Belgian interests) the yearly output of 18,000 tons of Donnersmarck. In the development and capitalization of the Lipine concern the Metallbank seems to hold an important position. The German subsidiary of Lipine (Silesian Mines and Smelters of Beuthen) participated in the Frankfort merger and has some interest in the Sachtleben. The ores of German Upper Silesia are still being moved across the frontier to be smelted in Poland and are then returned to Germany.

Production of Bauxite in the United States in 1927

PRODUCTION of bauxite in the United States in 1927 was 320,940 long tons, valued at $1,988,780, a decrease of 18 per cent in both quantity and value, compared with 1926, according to a statement prepared by J. M. Hill, of the U. S. Bureau of Mines.

Exports of bauxite and bauxite concentrates have likewise increased, particularly in the last two years, since the great increase in aluminum manufacture in the Canadian and Norwegian plants of the Aluminum Company of America.

Bauxite (Including Bauxite Concentrates) Exported From the United States, 1923-1927

Year	Long Tons	Value
1923	78,560	$3,380,486
1924	77,065	3,979,832
1925	78,633	4,134,455
1926	87,770	4,741,260
1927	121,858	7,800,491

World production of bauxite has likewise been increasing along with the expansion in manufacture of aluminum, the growth of the chemical and abrasive industries, and the expanding demand for aluminous cements.

Bauxite Produced in the United States, 1923-1927

Year	Georgia, Alabama (a) and Tennessee		Arkansas		Total	
	Long Tons	Value (b)	Long Tons	Value (b)	Long Tons	Value (b)
1923	28,810	$176,030	493,880	$2,980,580	522,690	$3,156,610
1924	19,940	156,990	327,630	1,981,000	347,570	2,137,990
1925	20,220	109,800	296,320	1,878,450	316,540	1,988,250
1926	20,680	116,650	371,570	2,298,550	392,250	2,415,200
1927	17,110	95,920	303,830	1,892,860	320,940	1,988,780

(a) No production from Alabama in 1924, 1925, and 1926 and no production from Tennessee in 1927.
(b) Value f. o. b. mines.

The sales of domestic bauxite by producers to various consuming industries in the last five years are given in the following table:

Domestic Bauxite Sold by Producers to Industries in the United States, 1923-1927

(In Long Tons)

Year	Aluminum	Chemical	Abrasive	Cement and Refractory	Tota
1923	380,520	68,870	72,830	470	522,690
1924	225,780	54,870	66,400	520	347,570
1925	173,040	67,420	73,720	260	314,440
1926	241,850	77,960	72,210	230	392,250
1927	186,490	62,410	71,790	250	320,940

Imported bauxite, particularly that from South America, has been of increasing importance to domestic consumers, as shown by the following table which compares imports with domestic production:

Supply of Bauxite in the United States, 1923-1927

Year	Domestic Production		Imports		Total New Supply	
	Long Tons	Value	Long Tons	Value	Long Tons	Value
1923	522,690	$3,156,610	119,020	$593,882	641,710	$3,750,492
1924	347,570	2,137,990	201,974	909,493	549,544	3,047,483
1925	316,540	1,988,250	353,696	1,549,120	670,236	3,537,370
1926	392,250	2,415,200	281,644	1,187,497	673,894	3,602,697
1927	320,940	1,988,780	356,580	1,572,236	677,520	3,561,016

No Change in Copper Refinery Production in 1927

OUTSTANDING features of the copper statistics for 1927, according to the U. S. Bureau of Mines, Department of Commerce, were a small decrease in smelter production from domestic ores, virtually no change in refinery production from domestic and foreign ores, a large decrease in imports, a large increase in exports, a decrease in total smelter and refinery stocks, a decrease in average price, and a large drop in domestic withdrawals.

Production of new refined copper from domestic and foreign sources made a little over 3,000,000 lb. more copper available for consumption in 1927 than in 1926, and a drop of 67,000,000 lb. in refined copper imported with an increase of 80,000,000 lb. in refined copper exported, made a difference of 144,000,000 lb. in available supply. Stocks of refined copper were 22,000,000 lb. larger at the beginning of 1927 than at the beginning of 1926, and at the beginning of 1928 were 25,000,000 lb. larger than at the beginning of 1927. Consequently the decrease in domestic withdrawals, 147,000,000 pounds, approximated the decrease in available supply.

Stocks of blister copper on hand at the smelters, in transit to refineries and at refineries, decreased sufficiently so that there were 29,000,000 lb. less copper in total smelter and refinery stocks than at the end of 1926.

The figures here given are obtained from smelters and refiners and represent the metal actually recovered, in terms of blister and refined copper, from materials treated in 1927. These figures do not exactly correspond with those showing the copper mined during the year. Annual smelter production and mine production, representing different steps in the production of copper, should not be confused as they do not agree precisely.

The smelter production of primary copper from domestic sources during 1927 amounted to 1,684,040,983 lb., a decrease of approximately 3 per cent. The value of smelter production decreased approximately 9 per cent in 1927. The average price of 2,836,000,000 lb. of copper delivered during the year, as reported to the Bureau of Mines by selling agencies, was 13.1c. a pound.

Copper produced in the United States from domestic ores, 1926-1927

(Smelter output in pounds)

State	1926	1927
Alaska	67,631,846	56,489,214
Arizona	729,324,537	681,168,117
California	30,442,961	25,802,603
Colorado	4,657,591	8,006,801
Idaho	1,171,262	1,811,103
Michigan	174,778,884	195,135,199
Missouri	54,378	5,041
Montana	257,271,936	225,208,853
Nevada	109,041,769	118,298,342
New Mexico	82,848,096	79,761,222
North Carolina	1,468,746	5,362,041
Oregon	279,223	484,652
Pennsylvania	495,698	2,149,182
Tennessee	18,601,586	14,498,951
Texas	17,102	25,460
Utah	259,649,158	267,705,597
Vermont	446,323	238,143
Washington	1,336,617	1,766,953
Undistributed	104,381	123,509
	1 7: 9 622,094	1,684,040,983

Golden Cycle Announces Open Contract for Refractory Ores

THE Golden Cycle Mining & Reduction Company, operating the Golden Cycle Mill at Colorado City, on the outskirts of Colorado Springs, Colorado, recently announced an open contract under which ores from the various mining districts of the state would be accepted on a custom basis. The contract applies to siliceous gold-silver, pyritic gold-silver, and telluride ores. Details of the contract are as follows:

Payments

Gold—Pay for all at $20 per ounce.

Silver—Deduct 1 oz. per ton and pay for 50 per cent if less than 5 oz. per ton; if 5 to 10 oz. per ton, pay for 65 per cent; if 10 to 20 oz. per ton, pay for 75 per cent; if 20 to 50 oz., pay for 85 per cent; if 50 to 100 oz., pay for 90 per cent; if over 100 oz. per ton, pay for 95 per cent of the silver contained. Payments for silver to be based on the New York market quotation on date of sampling, as published in *Engineering and Mining Journal*.

Charges

Three dollars per ton where value of ore is $10 per ton or less; $3.50 per ton where value of ore is $10 to $15 per ton; $4 per ton for ore valued at $15 to $20 per ton; $5 per ton for $20 to $40 ore; and $5.50 per ton where value of ore is more than $40 and less than $100 per ton.

Freight is paid by the Golden Cycle company and added to the treatment charge.

On ores containing 20 oz. silver per ton, or over, the treatment charge is increased by $1 per ton.

Treatment charges on telluride ores will vary from $1.75 a ton on ores of gross value under $5 per ton, up to $5.50 per ton on ores of gross value greater than $100 per ton.

Railroad companies are co-operating to permit transporting of lower-grade ores, and have announced the following freight rates to Colorado City from the various mining centers:

	Value of Ore, per Ton									
	$8	$12	$18	$20	$25	$30	$41	$50	$61	$100
	Freight Rate, per Ton of Ore									
From										
Boulder	....	....	....	....	....	....	....	$2.75	....	$3.25
Idaho Springs	....	....	....	$2.00	....	$2.25	$2.75	....	$3.25	3.65
Leadville	$2.20	$2.45	$2.75	....	$3.25	....	....	....	....	4.55

In the foregoing table the production is apportioned to the states in which the copper was mined. The figures represent the content of fine copper in the blister produced, the smelter output of ingot, and Lake copper from Michigan.

Primary and secondary copper produced by regular refining plants and imported, 1926-1927, in pounds

	1926	1927
Primary:		
Domestic:[1]		
Electrolytic	1,553,041,424	1,520,076,181
Lake	172,372,304	195,135,199
Casting	5,883,433	3,740,819
	1,731,297,161	1,718,952,199
Foreign:[1]		
Electrolytic	588,932,788	605,748,329
Casting	2,255,427	1,063,181
Refinery production of new copper	2,322,485,376	2,325,763,709
Imports of refined copper	170,565,766	103,279,082
Total new refined copper made available	2,493,051,142	2,429,042,791
Secondary:		
Electrolytic	163,061,465	168,766,566
Casting	62,056,941	41,102,000
	225,118,406	209,868,566
	2,718,169,548	2,638,911,357

[1] The separation of refined copper into metal of domestic and foreign origin is only approximate, as an accurate separation of the amounts at this stage of manufacture is not possible.

In addition to their output of metallic copper the regular refining companies produced bluestone (hydrous copper sulphate) having a copper content of 9,180,000 lb., as compared with 8,498,000 lb. in 1926.

The new refined copper withdrawn from the total year's supply on domestic account in the United States in 1927 and the method employed in determining it are shown in the following table, which does not include stocks of copper held by consumers.

New refined copper withdrawn from total year's supply on domestic account, 1926-1927, in pounds

	1926	1927
Total supply of new copper	2,493,051,142	2,429,042,791
Stock at beginning of year	124,000,000	146,000,000
Total available supply	2,617,051,142	2,575,042,791
Copper exported[1]	900,914,935	981,083,572
Stock at end of the year	146,000,000	171,000,000
	1,046,914,935	1,152,083,572
Withdrawn on domestic account	1,570,136,207	1,422,959,219

[1] Includes refined copper in ingots, bars, rods, or other forms.

Stocks

Stocks of copper January 1, 1923, 1924, 1925, 1926 1927 and 1928, in pounds

Year	Refined Copper	Blister and Material in Process of Refining[1]
1923	216,000,000	361,000,000
1924	264,000,000	432,000,000
1925	243,000,000	393,000,000
1926	124,000,000	432,000,000
1927	146,000,000	455,000,000
1928	171,000,000	401,000,000

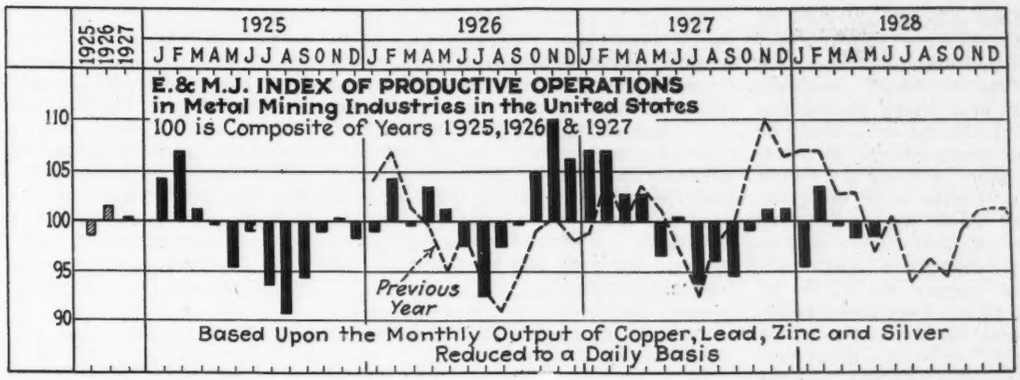
[1] The amounts stated in the last column in the table above do not include copper in stock at foreign smelters or in transit from foreign smelters to refineries in the United States.

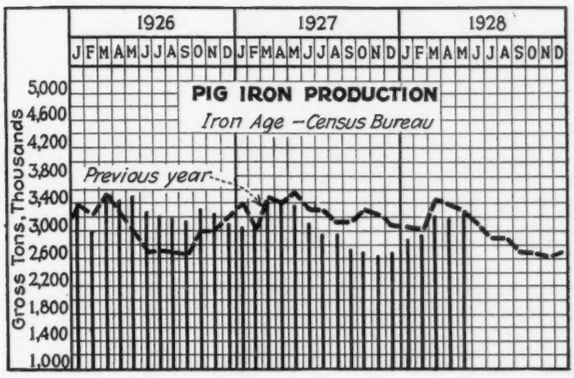
NEVADA CONSOLIDATED COPPER reports net income of $2,278,061 in the first quarter of 1928 which compares with net income of $1,871,893 in the last quarter of 1927. Production of copper was higher by 71,128 lb. than in the preceding quarter.

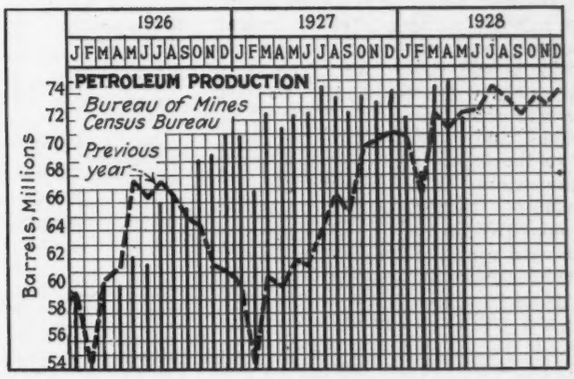
The average recovery in the form of concentrates from all company material milled during the period was 86.94 per cent of the total copper contained therein, corresponding to 22.33 pounds of copper per ton treated, as compared to a recovery of 86.83 per cent and 22.11 pounds per ton for the last quarter of 1927.

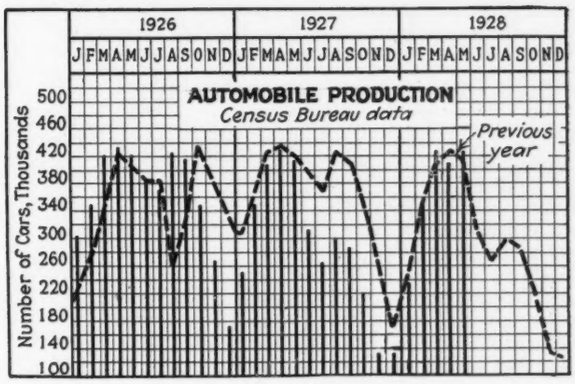
Indicators of Industrial Activity

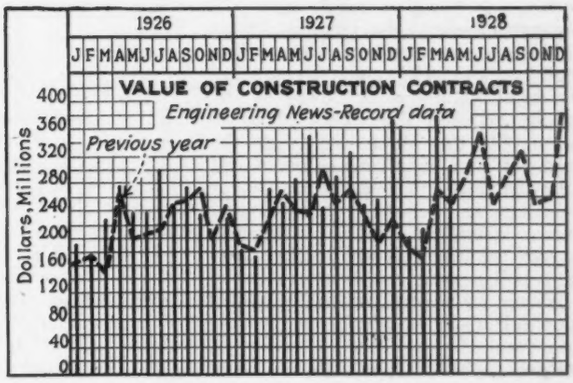
of Significance to Mining

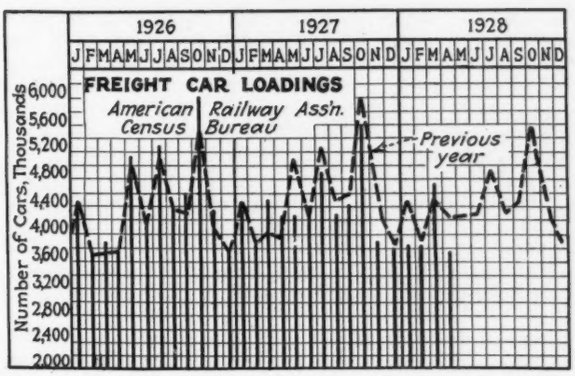


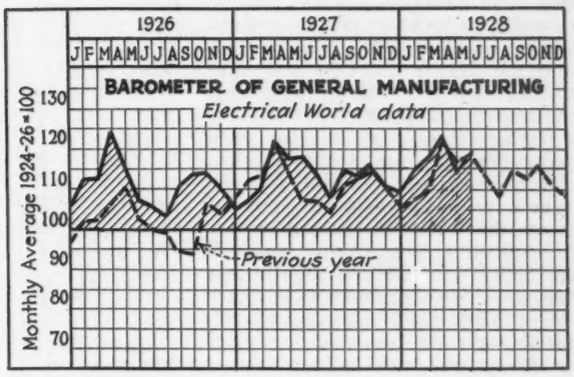












Operation of London Tin Market

How Closing Prices for Tin Are Fixed on the Metal Exchange

By W. A. Doman
Special London Correspondent

CONSUMERS of tin, on noticing the great difference shown every year between the highest and lowest prices touched by this metal, may have wondered how such sharp fluctuations occur and how much easier it would be to satisfy their requirements at a reliable price if more stability were seen in the market. Unlike some commodities dependent upon the success or failure of the harvest, there is no marked seasonal fluctuation, and movements in price appear to follow no definite rule or plan. Over an extended period of several years there is, of course, only one factor of importance, the law of supply and demand, and the main trend of prices, upward or downward, will depend upon whether demand is outstripping supply or whether the opposite is the case. But a chart of metal prices will show that in between there are sharp peaks and sharp depressions, and these can only be attributed to the caprices of Dame Fortune.

The market is a favorite one for speculators. Indeed, sentiment plays an enormous part in the day to day fluctuations, and even though conditions, such as rising stocks and supplies in sight, may point to a fall, if the sentiment is good and bullish the price will rise in spite of all. Should the mood, however, be bearish, one can talk of a famine without apparently stopping the setback.

The great bulk of the business in tin in London is done while the Metal Exchange is in session, and only a relatively small trading is attempted on the telephone between the offices of metal brokers. On the Metal Exchange the brokers sit in a ring and offer or bid for the metal in such quantities and at such prices as they are prepared and desirous to buy or sell at. Promptly at twenty minutes past one in the afternoon, a bell is rung and dealings cease, the closing price sent out to the world being the last one at which the metal is bid for and the last one at which it is offered. Usually the difference between these two prices is only two shillings and sixpence.

Actually, no business may have been transacted at these levels and all trading on the day in question will have been done above, or below, the closing prices according to whether the tendency during the session has been good or bad. The importance of these closing prices lies in the fact that throughout the world contracts are entered into on the basis of closing prices in London on a certain day. Smelters accept delivery of ore and concentrates paying for the tin contents at so much above or below, and shipments of ore or metal may also be made, the value being determined later on the basis of the London closing price.

As can be readily seen, this practice opens a way for a certain amount of market management. If the price of a large shipment depends upon the trend of the London market on a particular day, it is only natural that both parties, through their agents, should endeavor to obtain as favorable a closing price as possible. But in trying to lower or raise the price in this manner, brokers have to be prepared to have their offer or bids accepted and to stand by the business transacted.

Engels Copper Reports Loss in 1927

ENGELS Copper Mining Company, operating in Plumas County, Calif., reports a net loss of $138,346 in 1927, before deducting allowance for depletion, but after depreciation. In view of the large amount of development and exploration work completed during the year, the result is considered satisfactory. With the improvement shown at present in the price of copper, a very satisfactory year is anticipated in 1928.

Operating and marketing cost in 1927 compare favorably with the record for the preceding year. The large amount written off against income for mine development and exploration in 1927 accounts for the increased final per-pound cost. Details follow:

Cost of Copper Production—Engels Copper Mining Company

	1927	Cost per Ton of Ore	1926	Cost per Ton of Ore
Tons of ore	384,671	.....	421,618	.....
Mining cost	$498,091	$1.2949	$584,114	$1.3854
Milling cost	259,974	0.6758	285,751	0.6777
Taxes, interest, and insurance	89,238	0.2320	103,960	0.2466
Electric haulage	25,027	0.0651	25,922	0.0615
Loading concentrate	2,991	0.0078	3,116	0.0074
General expense, administration and superintendence	44,029	0.1144	51,194	0.1214
TOTAL OPERATING COST	$919,354	$2.3900	$1,054,061	$2.5000
Depreciation	77,968	0.2027	105,021	0.2491
Development and exploration	273,249	0.7103	51,152	0.1213
TOTAL COST—EXCLUSIVE OF FREIGHT AND DEVELOPMENT CHARGES	$1,270,572	$3.3030	$1,210,234	$2.8704

		1927 Total Cost	1927 Cost per Pound, Cents	1926 Cost per Pound, Cents
Operating cost		$919,354	7.5843	7.8986
Freight and smelting charges	$571,487			
Credit by gold and silver	99,784	471,703	3.8914	3.9603
Operating and marketing cost		$1,391,057	11.4757	11.8589
Add reserve for depreciation		77,968	.6432	.7870
Add development and exploration amortization		273,249	2.2542	.3833
Total cost of copper production		$1,742,276	14.3731	13.0292

Talc Production in 1927 Increased 6 Per Cent

TOTAL quantity of talc sold by producers in the United States in 1927 was 192,316 short tons, valued at $2,234,724, according to figures compiled by the U. S. Bureau of Mines, from individual reports furnished by producers. The figures comprise 5,706 tons of crude talc, valued at $25,365; 1,494 tons of sawed and manufactured talc, valued at $111,650; and 185,116 tons of ground talc, valued at $2,097,709. Both total quantity and value increased 6 per cent as compared with 1926.

Of the total quantity sold the state of New York supplied 94,553 tons, valued at $1,191,453, as compared with 83,231 tons, valued at $1,030,075, in 1926; Vermont supplied 54,688 tons, valued at $503,716, as compared with 53,510 tons, valued at $514,527, in 1926; and California supplied 15,760 tons, valued at $238,755, as compared with 15,419 tons, valued at $233,292, in 1926. The remainder of the output was produced by Georgia, Maryland, New Jersey, North Carolina, Pennsylvania, and Virginia.

Imports of talc for consumption in 1927 were 25,194 short tons, valued at $550,382.

China's Antimony Output Higher

CHINA, one of the world's chief sources of antimony, has increased its output of that mineral, valuable in fine steel alloys, despite internal disturbances in the country, according to the Department of Commerce.

Antimony output for the first quarter of 1928 in the Providence of Hunan reached approximately 4,400 tons, higher than the average quarterly production last year. January production totaled 1,300 tons, February 1,200 tons and March 1,900 tons.

Increased output, especially toward the last of the quarter, was attributed to improved labor conditions at the mines as a result of the partly successful campaign against the outlaw troops in the province. At the end of March about 30 smelters were operating in Hunan, chiefly at Sikwanshan.

During the first quarter of the current year shipments of antimony regulus from Changsha totaled 3,940 tons, of which 2,021 were landed at Hankow for re-export from that point and the remainder went to Shanghai for export.

Exports of antimony regulus to the United States declared through the Hankow consulate general amounted to 1,930 tons in the first quarter.

The Market Report

Metal Markets Quiet and Steady

New York, June 27, 1928—Buying of each of the non-ferrous metals has been of modest proportions during the week ending today. Prices are for the most part unchanged, copper continuing at 14¾c., Connecticut, and lead at 6.30c. in New York and 6.15c. in St. Louis. Zinc is a little firmer than a week ago, the forward position commanding as high as 6¼c. Tin and quicksilver are each slightly firmer, and antimony is unchanged. Silver during the week again passed 60c. and closed at 60⅛c.

Lull in Copper Buying

Consumers finally have dulled their keen demand for copper, and after nine consecutive weeks of better-than-average business, including two or three of close-to-record proportions, the market has been much less active. This applies to foreign more than to domestic buying. Producers are pleased with the turn of events. Their books show that they are well sold for July, and August production is provided for to some extent. At the same time the requirements of users are supplied and a period of dullness is generally expected. The higher prices of the last two months already have had the effect of speeding up production in several mining districts. Although this has not been reflected to a marked extent in the statistics, there is no doubt but that higher production schedules are in effect. In one or two instances it is reported that inability to obtain necessary miners has interfered with plans to expand output. Some producers point out that the unusually large volume of buying in the last two months is not the result of increased current consumption by manufacturers so much as the replenishment of stocks of raw material in their warehouses that had been depleted by hand-to-mouth buying. On this ground they contend that stepping up of production should be done with circumspection. The prevailing prices have been 14.75c., Connecticut, and 14.875c. in the Middle-West. The foreign price continues at 15c. c.i.f. European ports.

Daily Prices of Metals

June	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
21	14.525	45.75	6.30	6.15	6.15@6.25
22	14.525	46.00	6.30	6.15	6.15
23	14.525	46.00	6.30	6.15	6.15
25	14.525	46.375	6.30	6.15	6.15
26	14.525	46.125	6.30	6.15	6.15@6.20
27	14.525	47.00	6.30	6.15	6.15@6.20
	14.525	46.208	6.300	6.150	6.167

Average prices for calendar week ending June 23, 1928, are: Copper, 14.531; Straits tin, 46.479; N. Y. lead, 6.300; St. Louis lead, 6.150; zinc, 6.158; and silver, 59.646.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

June	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
21	63 3/16	63 3/16	68¾	211⅜	208⅝	20 9/16	20 13/16	25 9/16	25¼
22	63 1/16	63 1/16	68½	207¾	204½	20½	20 11/16	25⅝	25 3/16
25	63⅛	63⅛	68½	211	208⅜	20⅝	20 13/16	25 9/16	25¼
26	62 15/16	63	68½	207¼	204⅞	20¼	20 11/16	25 3/16	25 1/16
27	63⅛	63⅛	68½	210½	207¾	20 11/16	20⅞	25 7/16	25¼

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

June	Sterling Exchange "Checks"	Silver		Gold London	June	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
21	4.87 9/16	59¾	27⅛	84s10¼d	25	4.87⅜	60	27⅜	84s10½d
22	4.87¼	59¾	27⅛	84s10½d	26	4.87¼	60⅛	27 7/16	84s10d
23	4.87⅜	59⅞	27⅜	.....	27	4.87⅛	60⅛	27 9/16	84s10½d

Avg. 59.938

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Lead Much Quieter

Demand for lead quieted down considerably, the tonnage sold being only about half that of last week. Most of the sales were for small lots for prompt shipment, though an occasional order was placed for July and August, the price being the same for all deliveries. The New York price of the American Smelting & Refining Company continued at 6.30c., and this level was also realized by other sellers. In the St. Louis market, producers quoted 6.15c., with a reasonable business at that level for chemical lead. The price cannot be said to be as firm as it was two or three weeks ago, intimations that a firm bid of 6⅛c. would not be rejected by some sellers continuing to be made by some market observers. Certain it is that consumers in Chicago, Detroit, and other Middle Western points are not obliged to pay the full freight differential over the St. Louis price in instances where they can use either chemical or desilvered lead. The fact that there is only 15 points difference between the New York and St. Louis quotations has a bearing here.

Demand has been well distributed between the battery, ammunition, corroding, cable, plumbing, and bearing-metal trades. The statistical position of the producers is good, and they do not seem at all worried about the present quiet market; most feel that if the market has any current price trend, it is upward rather than downward.

Firm Tendency in Zinc

The policy of ore producers in the Tri-State district of demanding $40 for their concentrate and not selling too freely at that level has been a factor in the strength of the zinc market. A

Mining Stocks—Week Ended June 23, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	65¼	61⅝	63¼	Ap.14, My.21 Q	0.75
Ariz. Com'l	Boston	4⅛	4⅛	4⅛	Ja. 19, Ja. 31 SA	0.25
Cal. & Ariz	New York	97⅜	92½	94½	Je. 8, Je. 25 Q	1.50
Calumet & Hecla	Boston	22⅜	21	22¼	My. 31, Je. 15 Q	0.50
Cerro de Pasco	New York	71	68½	69½	Ap.12, My.1 Q	1.00
Chile Copper	New York	45	41⅛	44½	Je.6, Je.30 Q	0.62½
Con. Coppermines	N. Y. Curb	12⅝	9⅞	11⅛		
Copper Range	Boston	19	16½	18½	Mr. 24, Ap. 20 A	1.00
Crystal Copper	Boston Curb	*49	*41	*47		
East Butte	Boston	2⅜	2⅜	2⅜	Dec., 1919	0.50
Granby Consol	New York	53⅜	50½	52⅛	Jl.13, Au.1 Q	1.00
Greene Cananea	New York	100	8 ⅜	95⅛	Je. 15, Jl. 2	1.00
Howe Sound	New York	58½	52¾	56¾	Je.30, Jl. 16, Q	1.00
Inspiration Consol	New York	21⅛	20	20⅛	Apr. 1927 Q	0.25
Isle Royale	Boston	17⅛	16	16⅛	Fe.28, Mr.15 SA	0.50
Kennecott	New York	88⅛	84½	87⅛	Jl. 1, Jl. 2 Q	1.25
Magma Copper	New York	50⅛	47⅛	48⅜	Jl.29, Jl.16 Q	0.75
Mason Valley	N. Y. Curb	1½	1½	1½		
Miami Copper	New York	19¾	19⅛	19⅛	My.1, My.15, Q	0.37½
Mohawk	Boston	58	55	57	Ap. 30, Je. 1 Q	1.00
Montana-Idaho	Spokane	*25½	*23	*23½		
Mother Lode Coal	New York	3	2⅜	2⅜	Je.8, Je. 30, SA	0.15
Nevada Consol	New York	22⅛	21⅛	21⅛	Je.15, Je.30 Q	0.375
New Cornelia	Boston	28⅛	27⅛	27⅛	My. 4, My. 21 Q	0.50
Noranda	N. Y. Curb	38	34⅜	36⅞		
North Butte	Boston	2½	2⅜	2⅜	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*79	*70	*75	Sept., 1926	0.03
Old Dominion	Boston	12	10	10½	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	148	138	140	Je.25, Jl.22 Q	2.00
Quincy	Boston	30	27½	28	March, 1920	1.00
St. Mary's Min. Ld	Boston	30	28	28	Ap.1928 A	2.00
Seneca Copper	New York	3	2⅜	2⅜		
Shattuck-Denn	N. Y. Curb	15½	13⅜	14⅛		
Tenn. C. & C	New York	14⅜	13⅛	13⅜	My.29, Je.15,Q	0.12½
United Verde Ex	N. Y. Curb	14½	13⅛	14⅛	July 6, Q	0.50
Utah Copper	New York			152½	Je.15, Je.30 Q	1.50
Utah Metal & T	Boston	1½	1 1/16	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	1.47½	1.17½	1.15		
NICKEL-COPPER						
Internat. Nickel	New York	93½	87½	90¼	Je.14, Je 30 Q	0.50
Internat. Nickel pfd	New York	116	115	115	Ap.12, My.1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*2½	*2	*2½	June, 1927	0.005
National Lead	New York	120	116	117	Je.15, Je.30 Q	1.25
National Lead, pfd. A	New York	146	146	146	Je.1, Je.15 Q	1.75
National Lead, pfd. B	New York	120½	120½	120½	Jl. 20, Au. 1 Q	1.50
St. Joseph Lead	New York	41¼	40	41½	Je.9, Je.20, QX	0.75
ZINC						
Am. Z. L. & S	New York	24⅜	20⅛	23⅛	May, 1917	1.00
Am. Z. L. & S. pfd	New York	84⅛	80⅛	84½	Nov., 1920	1.50
Butte C. & Z	New York	7⅛	6⅛	7	De., 1926	0.50
Butte & Superior	New York	12⅛	11	11⅛	Je.15,Je.30 Q	0.50
Callahan Zn-Ld	New York	3⅛	2⅛	3⅛	De., 1920	0.50
Consol.Lead&Zinc 'A'	St. Louis	14⅛	12	12	Je.25, Jl.1 Q	0.25
Eagle-Picher	Cincinnati	17⅛	16⅛	17⅛	No.15, De.1 Q	0.40
Eagle-Picher pfd	Cincinnati	100⅛	100	100	Mr. 31, Ap. 16 Q	1.50
New Jersey Zn	N. Y. Curb	217⅛	210	210⅜	Je. 20, Jl. 10 X	2.00
Treadwell-Yukon	Toronto	18.75	18 00	18 00		
United Zinc	N. Y. Curb	*80	*60	*60		
Yellow Pine	Los Angeles	*30	*30	*30	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	3⅛	3⅛	3⅛		
Ankerite	Toronto			*41		
Barry-Hollinger	Toronto	*81	*70	*71½		
Central Manitoba	Toronto	1.27	1.23	1.25		
Cresson Consol. G	N. Y. Curb	1⅛	1 1/16	1⅛	Je.30, Jl.10 Q	0.10
Dome Mines	New York	9	8¼	8¼	Je.30, Jl.20 Q	0.25
Golden Cycle	Colo.Springs	†1.70	†1.68		My. 31, Je.10 Q	0.04
Gold Hill	Toronto	*12	*10½	*11½		
Hollinger Consol	Toronto	14.50	14.00	14.00	Je.27, Jl.14 FW	0.10
Homestake Mining	New York	71	71	71	Je.20, Je.25 M	0.50
Kirkland Lake	Toronto	1.83	1.75	1.76		
Lake Shore	Toronto	23.60	23.00	23.15	Je.1, Je.15 QX	0.20
McIntyre Porcupine	New York			26½	May1, Je.1 Q	0.25
Portland	Colo.Springs	†*13½	†*13		Ap., 1927	0.02
Rand Mines	New York	39½	39½	39½	Fe.21-28 Am.Sh.	1.52
Sylvanite	Toronto	3.05	3.00	3.00		
Teck-Hughes	Toronto	10.80	10.40	10.55	Jl. 17, Au. 1 SAX	0.15
Tom Reed	Los Angeles	*54	*41	*48	Dec., 1926	0.02
Tough-Oakes	Toronto	*27½	*24½	*27		
Vipond Cons	Toronto	*54½	*53½	*54	April, 1927	0.03
Wright-Hargreaves	Toronto	4.50	4.17	4.21	Ap.13, My.1 Q	0.05
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	20	18½	19		
Con. Cortez	N. Y. Curb	*30	*28	*30		
Dolores Esperanza	N. Y. Curb	1½	1	1½	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb			15	Ap.18, Ap.28 Q	0.50
Premier Gold	N. Y. Curb	2⅜	2 1/16	2⅛	Je.14, Jl.3	0.06
Tonopah Belmont	N. Y. Curb	*95	*95	*95	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb			*1	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb			4	Mar.31, Ap.21 SA	0.07½
West End Consol	N. Y. Curb		*3	*4	Mar., 1923	0.05
Yukon Gold	Boston Curb	*61	*61	61	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	1.33	1.25	1.26	May, 1920	0.03
Castle-Trethewey	Toronto	*58	*58	*58		
Coniagas	Toronto	4.75	4.60	4.65	May, 1924	0.12½
Keeley	Toronto	*64½	*63	*64	Mr.1, Mr.15 SA	0.04
Lorrain Trout Lake	Toronto			*50	July 1925	0.05
Mining Corp. Can	Toronto	3.32	3.18	3.20	My 21, Je.13 SA	0.125
Nipissing	N. Y. Curb	4	3⅜	4	Je.30 Jl.20Q	0.075

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	3⅜	3⅛	3⅜	Ap., 1927	0.12½
Bingham Mines	Boston			45	Je.23, Jl.5 Q	1.00
Bunker Hill & Sullivan	N. Y. Curb	121½	121	121½	June 10, MX	0.75
Cardiff M. & M	Salt Lake	*70	*70	*70	Feb. 5, 1927	0.10
Chief Consol	Salt Lake	4.50	4.12½	4.45	Ja.10, Fe.1 K	0.10
Consti'n Mng.&Mill'g.	Spokane	*23	*.5	*15		
Erupcion	Boston Curb	*30	*30	*30	Dec. 13, Jan. 3,	0.07½
Eureka Lily	Salt Lake	2.30	2.22½	2.22½		
Federal M. & S	New York			125	Je., 1927	10.00
Federal M. & S. pfd	New York	98⅛	97½	98⅛	My.25, Je.15 Q	1.75
Hecla Mining	N. Y. Curb	15	14⅛	14⅛	My.15, Je.15 Q	0.15
Highland-Surprise	Spokane	*13⅜	*11	*12½		
Iron King Mining	Salt Lake	*91	*79	*89		
Keystone Mining	Salt Lake	*27	*25	*27	Fe., 1926	0.07½
Lucky Jim	Spokane	*29	*26	*26		
Lucky Tiger-Com	Kansas City	†7.85	†7.70		Je.7, Je.20 MX	0.07
Mammoth Mining	Salt Lake	1.40	1.40	1.40	De., 1926	0.25
North Lily	Salt Lake	8.00	7.50	7.50		
Park Utah	New York	11⅜	10⅜	11⅛	Je.15, Jl.2 Q	0.20
Plutus Mining	Salt Lake	2.00	2.00	2 00	Ap.10, Ap. 16 Q	0.10
Rico-Argentine	Salt Lake			*52	June 15	0.03
Silver King Coal	Salt Lake	11.75	11.50	11.75	Je.20, Jl.2 Q	0.25
Silversmith	Spokane	*14½	*13½	*13½	Oct., 1926 Q	0.02
Strattons Mines	Spokane	*78	*60	*72		
Sunshine M. Co	Spokane	1.48	1.40	1.40	June 20,	0.02
Tamarack-Custer	Spokane	*51⅞	*46	*46	Sept., 1924	0.25
Tintic Standard	Salt Lake	14.50	13.75	13.75	Je.18, Je.30 QX	0.30
Utah-Apex	Boston			·⅛	Oct., 1926	0.25
IRON						
Bethlehem Steel	New York	54⅜	51⅞	53⅜	Jl., 1924	1.25
Cleveland-Cliffs Iron	Cleveland	110	104½	109	Ap.13, Ap. 25. Q	1.00
Colorado Fuel & Iron	New York	61	55½	55½	May, 1921	0.75
Gt. North'n Iron Ore	New York	20½	19½	19½	Ap. 9, Ap. 30 K	0.75
Inland Steel	New York	54	53	53	My. 15, Je.1 Q	0.62½
Republic I. & S	New York	53½	49⅛	50⅛	My.15, Je.1 Q	1.00
Republic I. & S. pfd	New York	106	104½	104½	Je. 15, Jl. 2 Q	1.75
Sloss-Sheffield S. & I	New York	102½	102	102	Je.9, Je.20 Q	1.50
Sloss-Snef. S.&I. pfd	New York			115½	Je. 20, Jl. 2 Q	1.75
U. S. Steel	New York	138⅛	132⅜	133⅜	My.31, Je.29 Q	1.75
U. S. Steel, pfd	New York	142⅞	141½	141⅜	Ap. 30, My. 29 Q	1.75
Virginia I. C. & C	New York			14½	Jan., 1924	1.50
Virginia I.C.&C. pfd	New York			55	Je. 16, Jl. 2 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York			27	July., 1927	1.45
So. Am. G. & P. New	N. Y. Curb	3⅜	3⅜	3⅜		
Alum. Co. of Amer	N. Y. Curb	157	134½	134½		
Alum. Co. of Amer. pf.	N. Y. Curb	108⅜	107½	107½	Je. 15, Jl. 1 Q	1.50
Vanadium Corp	New York	73½	65½	67½	My. 1, My. 15 Q	0.75
Patino M. & E	New York	30	26½	29	April, 1928	4s.
ASBESTOS						
Asbestos Corp	Montreal	30½	30	30½	Jan., 1926	1.50
Asbestos Corp. pfd	Montreal	92	90	91	Mr. 31, Ap. 16 Q	1.75
SULPHUR						
Freeport Texas	New York	67½	63½	64½	Jl.14, Au.1 QX	1.75
Texas Gulf	New York	65⅞	63	64⅜	Je.1, Je.15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	47½	45½	47	My.15, Je.1	0.75
Amer. Metal, pfd. 6%	New York	113	113	113	My.15, Je.1	1.50
Amer. Met. pfd. 7%	New York			125	My.15, Je.1	1.75
Amer. Sm. & Ref	New York	189⅜	182½	187½	Jl 13, Au.1 Q	2.00
Amer. Sm. & Ref. pfd	New York	135	134	135	Au. 3, Se. 1 Q	1.75
Consol. M. & S	Montreal	262	254	257	Je.30, Jl.16 SAX	6.25
Newmont Mining	N. Y. Curb	158⅜	148⅜	151	Je.30, Jl.16 Q	1.00
U. S. Sm. R. & M	New York	46½	45⅛	46	Ap.5, Ap.14 Q	0.87½
U.S. Sm. R.&M. pfd	New York	63⅜	53⅛	53⅛	Ap.5, Ap.14 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED June 12, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Alaska Mexican ($5)	38/9	37/ 6	37/6			
Alaska Treadwell ($25)	122/6	120/—	120/—	Nov., 1926	4 (d)	
Aramayo Mines (25 frs.)	66/10½	63/9	65/—	May, 1928	5 p.c. (†)	
Burma Corpn. (10 rupees)	14/6	14/1½	14/4½	Jan., 1928	6 annas*	
Bwana M'Kubwa (5s)	5/—	4/7½	4/10½			
Camp Bird (2s)	4/7½	4/3	4/6	April, 1928	16½ p.c.	
El Oro (£1)	4/9	4/3	4/7½	Nov., 1924	2½ p.c.*	
Frontino & Bolivia (£1)	13/9	12/6	12/6	Jan., 1928	5 p.c.	
Mexican Corpn. (£1)	11/3	10/7½	11/—			
Mexico Mines of El Oro (£1)	35/—	28/9	32/6	Dec., 1926	3¾ p.c.*	
Mond Nickel	184 4½	172 6	172/6	Feb., 1928	7½ p.c.	
N'Changa Copper Mining	16/3	14/9	15/7½			
Oroville Dredging (£1)	4/—	3/6	3/9	Dec., 1923	3¾ p.c.	
Rhodesian Congo Border (£1)	33/1½	27/6	32/6			
St. John del Rey (£1)	11/10½	11/—	11/3	April, 1928	7½ p.c.	
San Francisco Mines (10s)	29 —	28/—	28/—	Jan., 1928	25s.	
Santa Gertrudis (£1)	16/10½	16/—	16/6	Jan., 1928	7½ p.c.	
Selukwe (2s. 6d.)	14/1½	12/7½	13/6	April, 1917	6¼ p.c.	
S. Amer. Copper (2s.)	3/—	2/7½	2/7½	Nov., 1917	75 p.c	
Tanganyika (£1)	63/—	57/9	59/4½	Aug., 1927	7½ p.c.	
Union Miniere de Haut-Katanga (Brussels)	12 110	10,500	11,000	July, 1927	182.60 (‡)	

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation. §U. S. Dollars.

further curtailment of production will be effected as a consequence of a shutdown of several days at the time of the Fourth of July holiday, and this, too, has helped the situation. Buying has been a little, but not much, below average, mostly at 6.15c. for prompt delivery. On the last two days 6.20c. has been realized on prompt. August metal has brought 6.25c., most of this business having been done on Thursday of last week.

Tin Meets Good Demand Before 45c. Is Reached

The decline of tin to close to 45c., a price to which considerable publicity has been directed, was arrested this week by much improved buying by both dealers and consumers, and for all positions, both prompt and forward. As a result of yesterday's good business here, the London market advanced £3 today, and with another good day here at advancing prices, tomorrow's London cable is expected to show another advance. The firm market in copper, lead, and zinc has undoubtedly had some effect on tin. Forward metal has sold at a discount of $\frac{1}{8}$c. in the last day or two, compared with prompt Straits.

Silver Advances

Purchases by India with limited offerings has been the cause of a steadily advancing market during the last week. Buying for China account, in the local market, has been on a smaller scale although reports from abroad state that China worked both ways. The closing tendency is steady.

Mexican Dollars (old Mexican pesos): June 21st and 22nd, 45$\frac{3}{4}$c.; 23rd, 45$\frac{7}{8}$c.; 25th, 46c.; 26th and 27th, 46$\frac{1}{8}$c.

Franc Is Stabilized

On June 24, the French Chamber of Deputies stabilized the franc at 25.52 francs to the dollar, the franc to contain 65.5 mg. of gold, 900 fine. New 5-, 10-, and 20-franc coins will be minted, as well as 100-franc gold coins. Closing cable quotations on Tuesday, June 26, were as follows: Francs, 3.93$\frac{15}{16}$c.; lire, 5.25$\frac{3}{4}$c.; and marks, 23.90$\frac{1}{4}$c. Canadian dollars, $\frac{1}{4}$ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York: Chinese brands, all positions, 9$\frac{1}{2}$c. Cookson's "C" grade, spot, 15$\frac{3}{8}$c.

BISMUTH—Per lb., New York, in ton lots. $2.10. Smaller lots, $2.25 and up.

CADMIUM—Per lb., New York: 65c. @75c., according to quantity.

IRIDIUM—Per oz., $275@$300 for 98@99 per cent sponge and powder. Market dull.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $46@$49. Small lots bring up to $55. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $78. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $73.50@$74 bid, $75.50@$76.50 asked. Market very quiet.

QUICKSILVER — Per 76-lb. flask, $121.50@$123, depending on quantity. San Francisco wires $123.67.

Prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of June 9.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn; 35@38c. Caucasian, washed, 53@55 per cent, 38@40c. Chemical grades unchanged from quotations in the June 9 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $10.75@$11.00, Western scheelite, $10.75@$11.00.

Chrome, Iron, Tantalum, and Titanium ores are unchanged from quotations in the June 9 issue.

Offers of Blende Do Not Equal Demand

Joplin, Mo., June 23, 1928

Blende	Per Ton
High	$42.20
Premium blende, basis 60 per cent zinc	$40.00@ 41.00
Prime western, basis 60 per cent zinc	40.00
Fines and slimes, 60 per cent zinc	36.00@ 39.00
Average settling price, all zinc	40.21
Galena	
High	$84.80
Basis 80 per cent lead	82.50
Average settling price, all lead	83.12

Shipments for the week: Blende, 12,331; galena, 2,738 tons. Value, all ores the week, $723,520.

Buyers of zinc ore sought to increase purchases, but sellers said reserve stocks were too low and did not care to sell. As a consequence only 7,240 tons of zinc ore was purchased. Of the 36,080 tons of reserve stock only about 20,000 tons is not sold. Purchasers of lead ore cleaned up this week on the large purchases made earlier this month, and sales were nominal, at an unchanged offering of $82.50 per ton of 80 per cent lead.

Platteville, Wis., June 23, 1928

Zinc Blende	Per Ton
Blende, basis 60 per cent	$42.75
Lead Ore	
Lead, basis 80 per cent lead	$82.50

Shipments for the week: Blende, 799 tons; lead, 40 tons. Shipments for the year: Blende, 18,100 tons; lead, 1,040 tons. Shipments for the week to separating plants: 1,067 tons blende.

Non-Metallic Minerals

BORAX—Per lb.: Carload lots, in bags, crystals, 3$\frac{1}{2}$c.; granulated or powdered, 3$\frac{1}{4}$c.; f.o.b. plant, Pennsylvania. Prices reduced from 4c. and 3$\frac{3}{4}$c. per pound, respectively, on June 8.

Amblygonite. Asbestos. Barytes. Bauxite, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the June 9 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c. Fair demand.

Antimony Oxide, Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the June 9 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105 quoted for last half, 1928. Spiegeleisen, 19@21 per cent, $32 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 96@98c. f.o.b. works.

Ferrocerium, Ferrochrome, Ferro molybdenum, Ferrophosphorus, Ferro silicon, Ferrotitanium, Ferrovanadium, Monel Metal, Nickel Silver and Yellow (Muntz) Metal are unchanged from prices in the June 9 issue.

Rolled Metals

Copper Sheets and Lead Sheets are unchanged from prices in the June 9 issue.

ZINC SHEETS—Price advanced from 9 to 9$\frac{1}{4}$c. per lb., f.o.b. works, effective June 7.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of June 9.

Iron, Steel, and Coke

Iron—Per gross ton, Valley furnaces, Bessemer, $17; basic, $15.75@$16; No. 2 foundry, $16.75@$17.25.

Steel—Base prices per gross ton, Pittsburgh, billets and slabs, $33; plates, structural shapes, and soft steel bars, per pound, 1.85@1.90c.

Coke—Per gross ton, Connellsville furnace, contract, $2.75@$3; spot, $2.60@$2.75. Connellsville foundry, contract, $3.50@$4.85; spot, $3.50@$4.50. By-product coke, Ohio and Kentucky, $7; Buffalo and Detroit, $8.50@$9.

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Current Prices of Mining Supplies

Rise and Fall of the Market

MOST of the price changes of the last month were advances. Current quotations are above May levels in wrought-steel pipe at New York warehouses, cast-iron pipe in Birmingham, pine and fir timbers at Chicago, linseed oil in Minneapolis and leather belting at New York Warehouses. Hollow tile declined in the New York market and explosives are lower in several of the Western cities.

SHEETS—Quotations are per 100 lb. in various cities delivered from warehouse, also the base price at mill:

	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
Galvanized No. 24	$3.60@$3.65	$5.10	$4.80	$5.50	$4.95

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh, Chicago and Birmingham in carloads:

	Pittsburgh	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00
Standard open hearth rails	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh mill for large mill lots, together with the warehouse prices at other places named:

	Pittsburgh	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$2.80	$3.55	$3.65	$3.85	$3.00
Track bolts	3.80	4.55	4.65	5.35	3.90
Standard section angle bars, splice bars or fish plates	2.75	3.40	4.25	4.25	3.00

STRUCTURAL MATERIAL—Following are base prices per 100 lb. in large mill lots, f.o.b. mill, Pittsburgh and Birmingham. At other cities listed, quotations are per 100 lb., delivered from warehouse:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.85	$2.05	$3.30*	$5.00	$3.25	$3.10	$3.25
Channel, 3 to 15 in.	1.85	2.05	3.30*	5.00	3.25	3.10	3.25
Angles, 3 to 6 in., ¼-in. thick	1.85	2.05	3.30*	5.00	3.25	3.10	3.25
Tees, 3 in. and larger	1.85	2.05	3.30*	5.00	3.25	3.10	3.25
Plates ¼-in. thick	1.85	2.05	3.30*	5.00	3.25	3.10	3.25

*250 to 3,999 lb.

WIRE ROPE—Discounts from list price, f.o.b. New York and territory east of Missouri River on regular grades of bright and galvanized, are as follows:

Cast steel round strand rope	20 %
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5 %
Plow steel round strand rope	35 %
Special steel round strand rope	30 %
Gavanized iron rigging and guy rope (add to list)	12½%

MANILA ROPE—Per lb., ¾-in. and larger, delivered in 1,200-ft. coils:

Atlanta	$0.25	New Orleans	$0.21½
New York	.24	Seattle	.21½
Chicago	.21	San Francisco	.21½

DRILL ROD (from list at warehouse)	New York	Cleveland	Chicago
	60%	55%	50%

WROUGHT IRON AND STEEL PIPE—The following discounts from list, are for large mill lots at Pittsburgh mill:

	Steel			Iron		
	Inches	Black	Galv.	Inches	Black	Galv.
Butt Weld	1 to 3	62	50½	1 to 1½	30	13
Lap Weld	2½ to 6	59	47½	3 to 6	28	13

WROUGHT-STEEL PIPE—From warehouses at the places named the following discounts from list hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
2½ to 6 in., lap welded	45%	51%	46%

CAST-IRON PIPE—The following are prices on bell and spigot pipe, Class B and heavier, f.o.b. per net ton, for large mill lots.

	Birmingham	New York	Chicago	St. Louis	San Francisco
6 in. and over	$34.00	$38.60	$39.20@41.20	$36.60	$41.00

MACHINE BOLTS—Square heads and nuts, up to 1x30-in., full packages, discount 50% from latest list, April 1, 1927, at warehouses in New York and vicinity

NUTS—Hot pressed or cold punched, square or hexagonal, blank or tapped, up to 1-in., inclusive, full packages, carry a discount of 55% from latest list, April 1, 1927, on immediate deliveries from warehouse stocks in New York and vicinity.

HOLLOW TILE—Price per block to contractors, in lots of 2000 pieces or over:

	New-York	Chicago	Philadelphia	St. Louis	San Francisco‡	Perth Amboy N. J., Factory
4x12x12	$0.0973	$0.076	$0.11	$0.078	0.108	
6x12x12	.1459	.104	....	.105	.156	$0.252*
8x12x12	.1824	.142	.22	.145	.255	.312†

*10x12x12; †12x12x12.

LUMBER—Price per thousand feet, board measure, for timbers:

San Francisco—Rough Douglas fir, No. 1 common, at yards:

	10-16-18 and 20 Ft.	22 and 24 Ft.
3x3 and 4	$28.00	$29.00
3x6 and 8	28.00	29.00
3x10-6 and 12	28.00	29.00

New York—Prices are for long-leaf, yellow pine timbers (rough) at wholesale, in quantities of 35,000 ft. or more, within lighterage limits:

	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	$41.00@43.00	$42.00@44.00
3x10 to 10x10	48.00@50.00	49.00@51.00
3x12 to 12x12	55.00@57.00	56.00@58.00

Chicago—Prices in carloads, f.o.b., for long-leaf, yellow pine timbers, No. 1 and Douglas fir, No. 1:

	Up to 20 Ft., Pine	Up to 32 Ft., Fir
3x4 to 8x8	$38.00	$39.50
3x10 to 10x10	46.50	39.50
3x12 to 12x12	56.50	39.50

Other Cities—Price for rough timbers delivered:

	8x8-In. x 20 Ft. and Under				3x12 to 12x12-In. 20 Ft. and Under	
	Pine	Fir*	Hemlock	Spruce	Pine	Fir*
Boston	$47.50	$47.00	$47.50	$50.00	$56.00	$54.50
Cincinnati	33.00	46.00	44.00	44.00	37.00	50.00
Denver	.....	31.25	.....	.....	.....	32.25
Minneapolis	51.00	46.25	36.25	.....	53.00	47.75
Kansas City, Mo.	40.50	38.75	.....	.....	53.50	38.75
Philadelphia	55.00	37.00	42.00	43.00	65.00	37@38

* Douglas Fir.

NAILS—The following quotations are per 100 lb. keg from warehouse:

	Pittsburgh Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.55@$2.65	$3.10	$3.60	$4.00	$2.83½	$4.95
Cut	2.80	.....	5.00	5.00	.....	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without charge for bags.* Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	$2.25@$2.35	$2.25@$2.35	$2.35@$2.50
Chicago, f.o.b.	2.05	2.05	2.05
Cleveland, f.o.b.	2.24	2.24	2.24

LIME—Delivered: New York quotes bbl. 280 lb. net; Chicago, 180 lb.:

	Hydrated, per Ton		Lump, per Barrel	
	Finishing	Common	Finishing	Common
New York	$21.00@22.00	$14.00@15.00	$4.00@4.10	$3.15@3.25
Chicago	20.00	18.00	.....	1.50

LINSEED OIL—These prices are per pound:

	New York	Chicago	Minneapolis
Raw in barrels (1 to 4 bbl. lots)	$0.11	$0.11	$0.117

WHITE AND RED LEAD—Per 100-lb. keg base price, f.o.b. New York.

	Dry	In Oil
Red	$13.25	$14.75
White	13.25	13.25

HOSE—Quotations at New York warehouses:

	Fire Protection	50-Ft. Lengths
Underwriters' 2½-in. coupled, single jacket (net)		$0.68 per ft.

	Air—Best Grade			
¾-in., per ft.	3 ply	$0.36½	4 ply	$0.44

Steam—Discounts from List

First grade	30–10%	Second grade	40%	Third grade 45%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting. Discounts from list are as follows:

Best grade	45%	Second grade	50%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply, at New York warehouses:

Grade	Discount from list
Medium	31½%
Heavy	27%

PACKING—Prices per pound at New York warehouses:

Rubber and duck for low-pressure steam, ⅛ in.	$0.90
Rubber sheet	.55
Rubber sheet wire insertion	.75

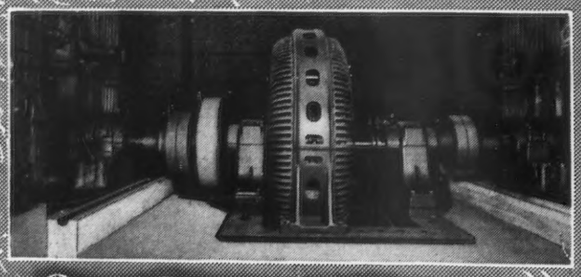
EXPLOSIVES—Prices per pound for dynamite delivered in small lots:

	Gelatin	
	40%	60%
New York (special gelatin in case lots)	$0.26	$0.2825
Minneapolis	.1967	.2123
Denver (f.o.b.)	.1925	.215
Seattle	.16	.185
Cincinnati	.22	.245
San Francisco	.1625	.1925

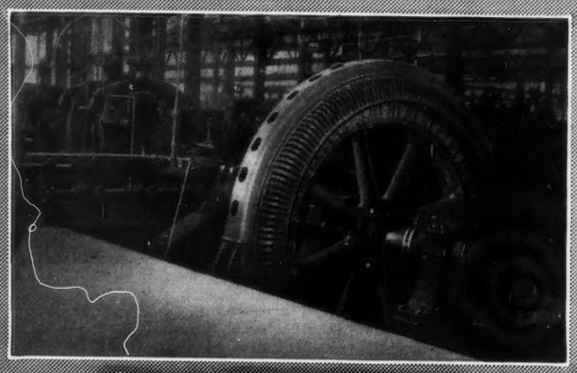
FLOTATION OIL—Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal. $0.33

CHEMICALS—Prices for round lots in New York market, per lb.:

Zinc dust, 550 lb. casks	$0.08½@.09
Litharge, casks	.08½
Sodium cyanide, 220 lb. single case lots	.18@.22
Calcium carbide, in drums	.05@.06



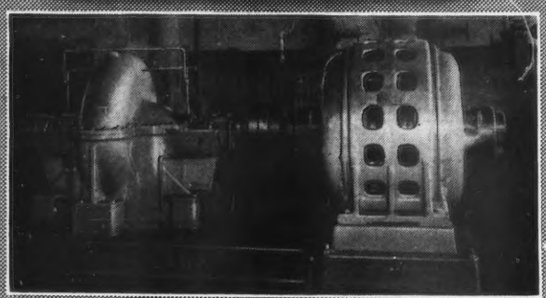
PULP GRINDER DRIVE



STEEL MILL DRIVE

FAN DRIVE

COMPEB MILL DRIVE



PUMP DRIVE

Synchronous Motor Drives

Allis-Chalmers Synchronous Motors are being used in a great variety of industrial applications.

They operate at a constant speed even under varying loads, and with uniformly high efficiency at fractional loads.

The ability to operate at unity power factor regardless of the power factor of the line, together with the corrective effect on the power factor of the system, that may be obtained by increasing their excitation, are prime reasons for the increasing demand for these motors.

Some typical installations are shown in the accompanying photographs.

Allis-Chalmers Synchronous Motors are built in a wide range of speeds and capacities for various service conditions.

Consult our Engineers regarding their possibilities in your plant.

ALLIS-CHALMERS MANUFACTURING COMPANY

Milwaukee, Wisconsin, U. S. A.

District Offices in All Principal Cities

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

The Old Time Prospector

THE old time prospector, once a familiar figure in the West, is seldom seen today. Scientific methods of finding and mapping ore bodies have largely replaced the work of this romantic figure.

Grub-staked and off for the hills.

But here is an old time prospector that is still making mining history. His iron constitution, and modern purpose keep him on the job—after 44 years of activity.

Sullivan Diamond Drill "No. 93" started drilling when Garfield was President. Before the present drilling crew was born, "No. 93" was boring holes, and getting accurate information for mining companies.

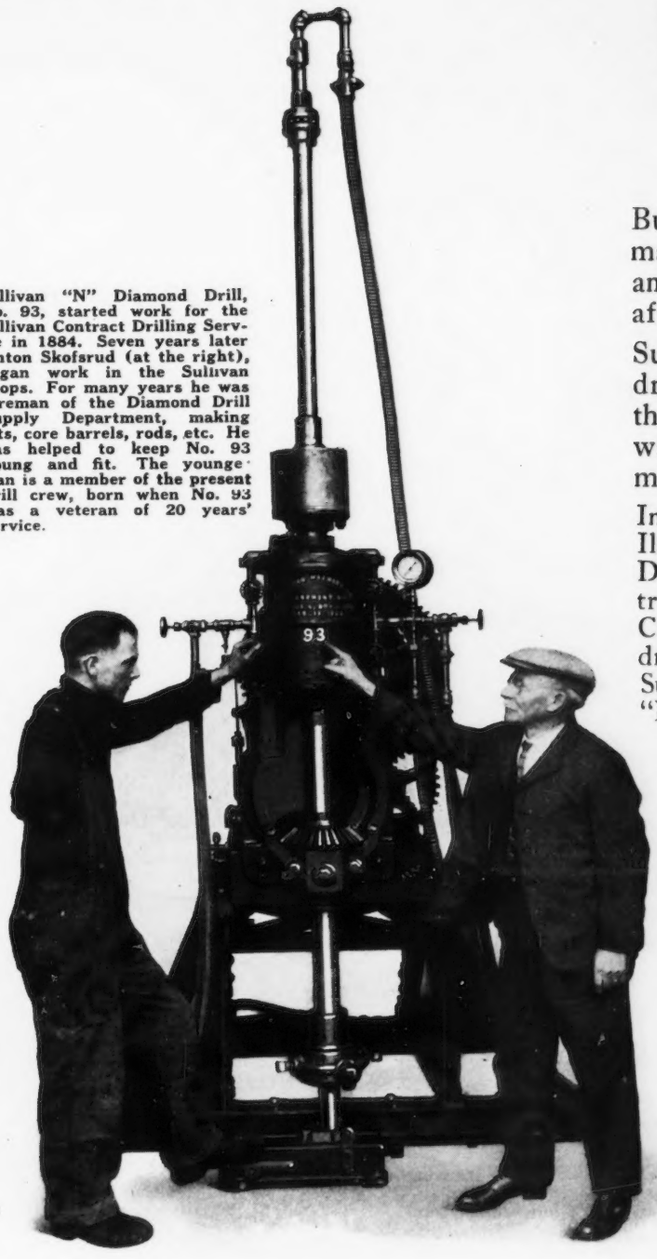
In 1884, "No. 93" was prospecting coal lands in Illinois, Indiana, and Iowa, for its owner, the Diamond Prospecting Co. (Since 1892 the Contract Drilling Department of Sullivan Machinery Company). Then, as the popularity of diamond drilling spread to world wide size—and the Sullivan Contract Drill Department grew—"No. 93" was moved to many places.

It has drilled a total of more than 125,000 feet in Illinois, West Virginia, Arkansas, Kentucky, Missouri, Pennsylvania, Tennessee, Indiana and Iowa.

An "old timer," to be sure! But while newer and improved Diamond Drills have been built, there has never been developed a prospecting method more scientific than diamond drilling—and Old Prospector "No. 93" is still on the job.

No matter where your property lies—and whether it is coal, ore, non-metallic deposits, or oil—you can secure the service of the Sullivan Diamond Drill Prospecting Department. And up-to-date Diamond Drills will give you the accurate and complete knowledge you need to develop the deposit.

Send for information.



Sullivan "N" Diamond Drill, No. 93, started work for the Sullivan Contract Drilling Service in 1884. Seven years later Anton Skofsrud (at the right), began work in the Sullivan shops. For many years he was foreman of the Diamond Drill Supply Department, making bits, core barrels, rods, etc. He has helped to keep No. 93 young and fit. The younger man is a member of the present drill crew, born when No. 93 was a veteran of 20 years' service.

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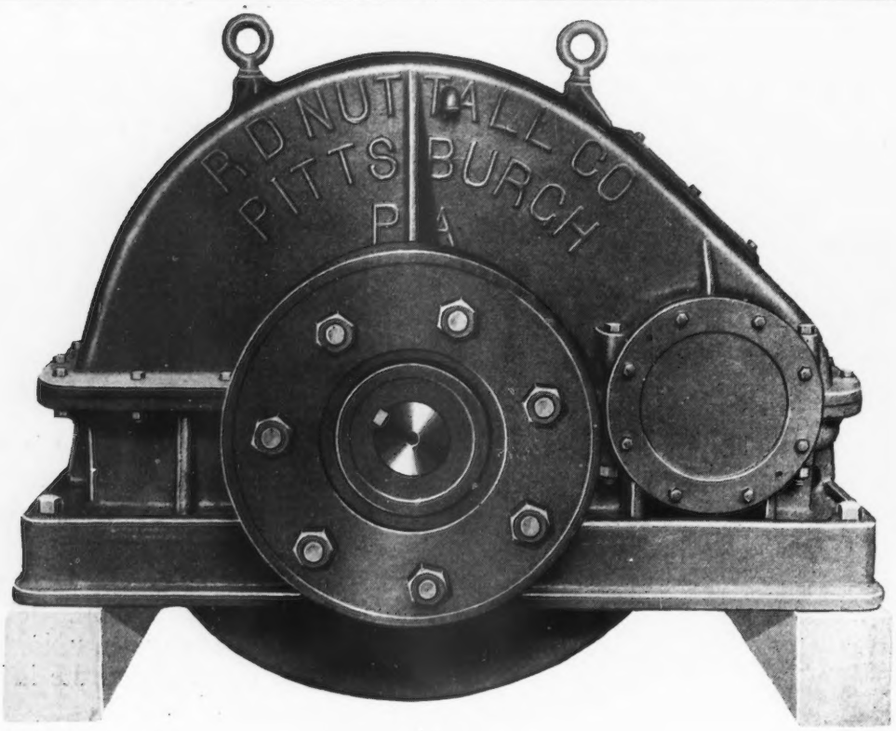


MR 25 Unit and flexible coupling

MR and MS Units
150 to 2000 horse power

When you put a Nuttall MS or MR Unit in service on that troublesome gear drive—you can forget your worries. Because Nuttall MS and MR Units are built to give continuous service day after day, week after week, year after year; doing their work, efficiently, quietly and demanding no attention beyond an occasional lubrication.

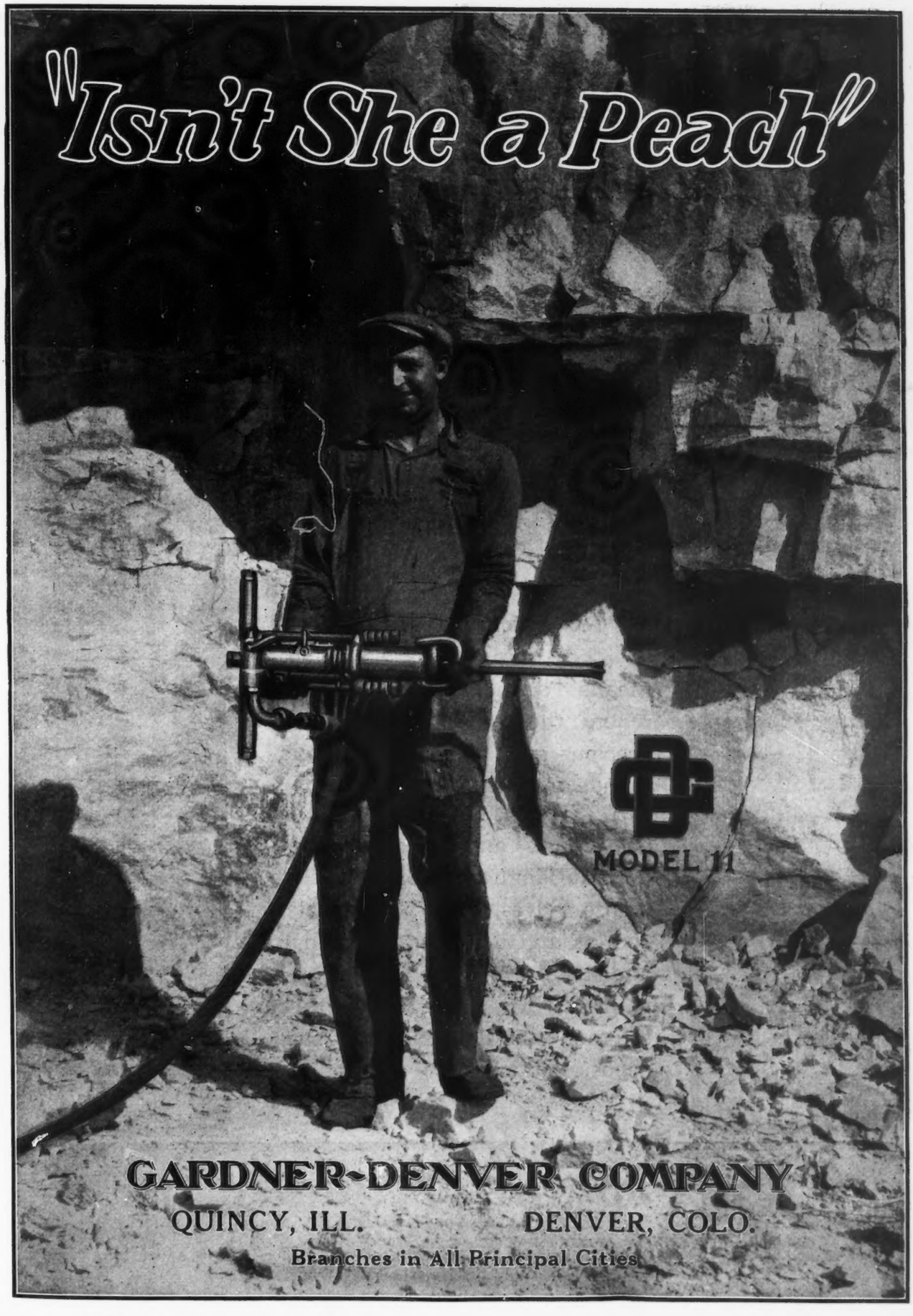
The carefully generated gears (either helical or herringbone), the high quality sleeve bearings of the MS and the Timken Tapered Roller Bearings of the MR Unit, the rigid, sturdy case, and the positive splash lubrication combine to assure continuous operation over a long period of time.

R. D. **Nuttall** Co.

Lyman Tube & Supply Co., Montreal, Toronto, Vancouver, Canada

Jobbers, Banks-Miller Supply Co., Huntington, W. Va.
Superior Supply Co., Bluefield, W. Va.

All NUTTALL Products are sold thru the Westinghouse Electric & Mfg. Co. district offices. Refer your inquiries to the nearest Westinghouse Office.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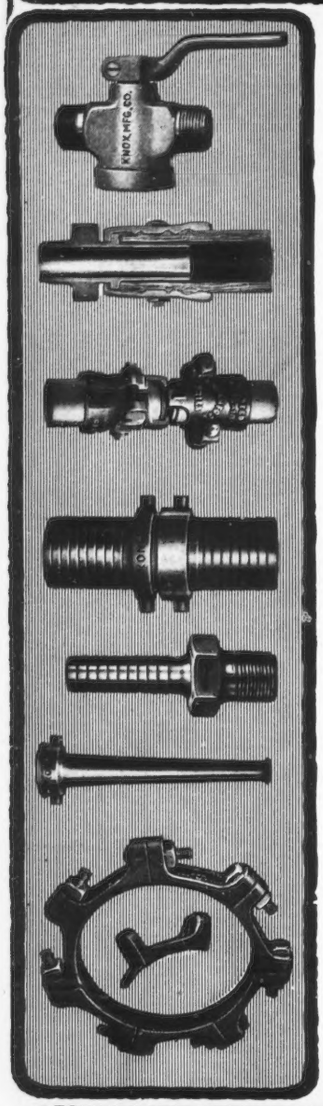
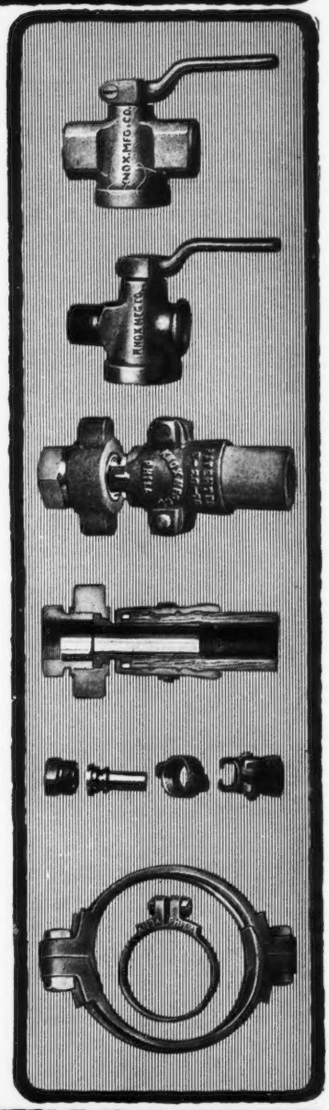


The same in any language

FROM Nome to the Rand, from the Andes to the Urals, "Knox" means "service" to the men on whom the world depends for its precious gold, silver, copper, diamonds and coal.

Say "Knox" anywhere and, whatever the language, they'll translate it into valves, couplings, nipples, clamps, and menders that stand up and stay on the job. They're built to match the rugged strength of the men who defy Nature's safe-deposit vaults.



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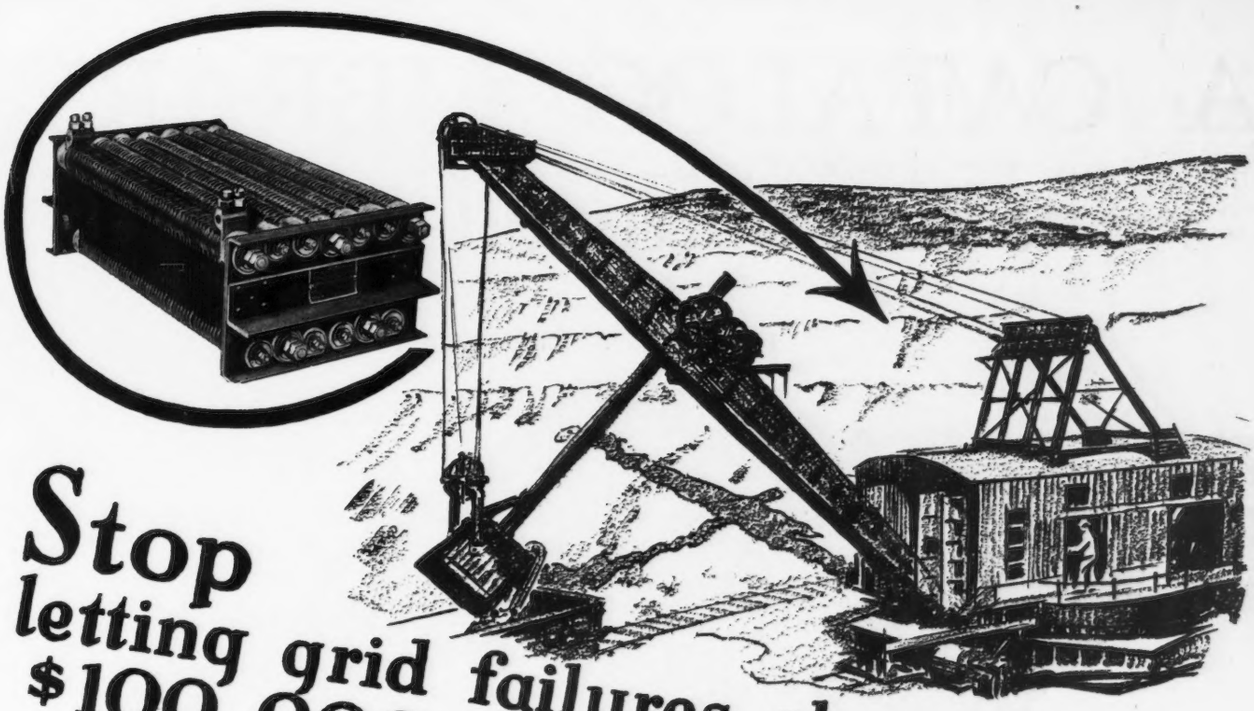

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You need these *unbreakable* grids wherever electrical resistance grids are used—for your Electric locomotives, hoists, overhead electric cranes, etc. They often outlast 10 ordinary cast iron grids. Ask any of our hundreds of users in the mining fields—they know.

Or better than just *telling* you all about them, let us ship you a P-G Grid for 90 days' free trial at *our* expense.

If you like to bet on a "sure thing" get off the coupon below today. No obligation—but we know you'll be back for more!

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For Locomotive	*For Electric Shovel, Overhead Crane, Blower, or Hoist*
Weight of Locomotive.....tons	H. P. of Motor.....
Voltage	Type of Mach. .....
Type of Controller	Type of Controller.....
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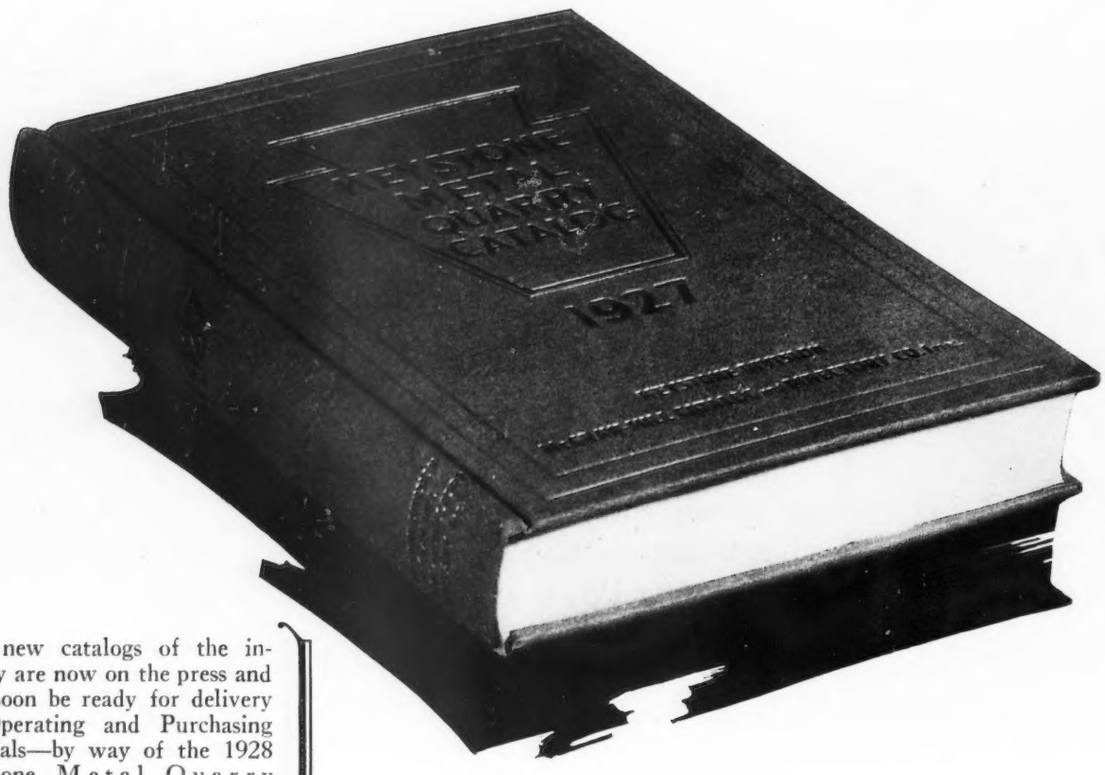

The new catalogs of the industry are now on the press and will soon be ready for delivery to Operating and Purchasing Officials—by way of the 1928 Keystone Metal Quarry Catalog.

IN YOUR handy Keystone Catalog you have *all together* the indexed catalogs of 370 manufacturers—a good sized catalog library!—giving you the buying information you seek on new mining machinery, materials or equipment.

The bringing together of all this catalog data into one indexed binder saves you the trouble of searching through many individual catalogs and the bother of filing and indexing—and eliminates the possibility of catalogs being lost or misplaced.

Get into the habit of "looking it up in Keystone" whenever you want catalog data to help you in your buying or specifying.

Rock Dust IS WONDERFUL FOR MINES to prevent explosions, etc., but in the "GUTZ" of A CRUSHER—not so good.

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Crushing Rolls
Jaw Crushers
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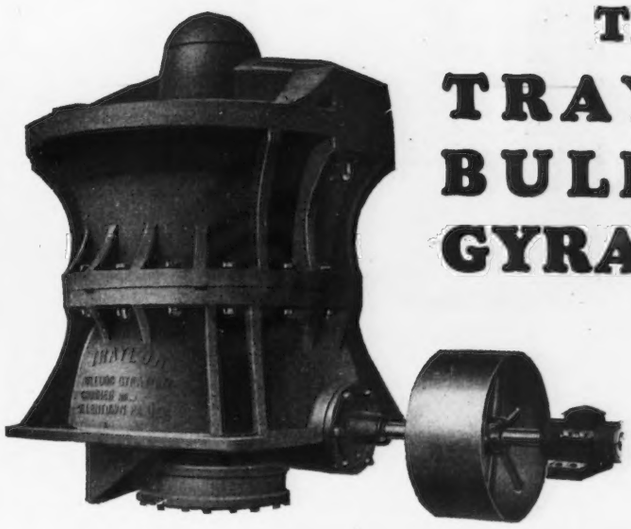
Lead Refining Plants
Smelting Plants



The TRAYLOR BULLDOG GYRATORY is

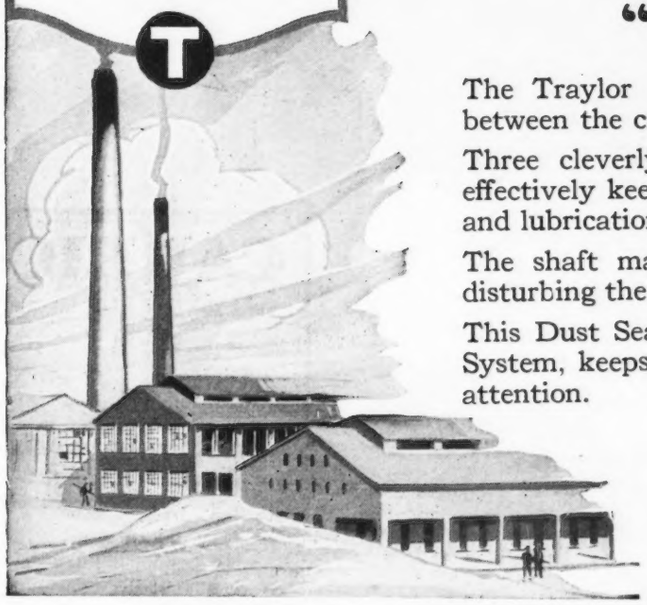
"DUSTSEALED"

The Traylor *"Dust Seal"* is an absolutely tight closure between the crushing head and the fixed eccentric bearing.

Three cleverly designed steel parts form the Seal and effectively keep all gritty, cutting dust out of the bearings and lubrication system.

The shaft may be adjusted, raised or lowered without disturbing the Seal.

This Dust Seal, plus the efficient Force Feed Lubrication System, keeps the Bulldog on the job with a minimum of attention.



Get complete particulars of the *other* 7 Traylor Bulldog Gyratory features from

BULLETIN 2100

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TIREX CABLES *in* PIT *and* QUARRY

at the Indiana Limestone Co., Bedford, Ind.

This general view is of a ledge at the Dark Hollow Quarry of the Indiana Limestone Company, Bedford, Ind., and shows five of the new style Bedford Channeling Machines in operation.

All of the cables shown on the floor of this quarry ledge are TIREX Cables consisting of No. 4, three conductor cables and 300,000 cm. single conductor cables.

It is on installations like this one where the going is rough and where loss of machines will not be tolerated that TIREX shows to the best advantage.

TIREX offers great resistance to abrasion because of its unusual construction and the "selenium rubber" outer sheath. More detailed information will be sent on request.

SIMPLEX WIRE & CABLE Co

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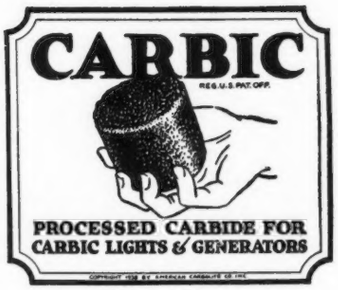
"You can't equal the Carbic for generator* portability"

IT couldn't be any simpler in construction. There are no moving parts. You can charge it in three minutes. Two men can carry it. It weighs only 200 pounds fully charged. It has unique safety features.

The initial cost is small and it is extremely economical to operate.

With a Carbic low pressure generator and a few drums of Carbic, you are always ready for any ordinary welding or cutting work.

Send for our new catalogue.



A standard drum of Carbic contains forty cakes, size No. 20. Carbic is distributed by the Union Carbide Sales Company through its national chain of warehouses.

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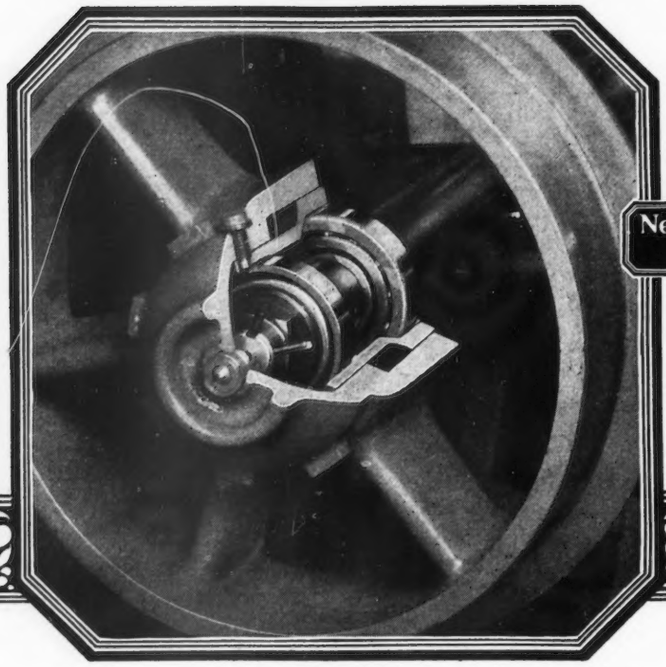

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New Bearing Mounting in Mine Car Wheels

NEW DEPARTURE engineers have developed a new wheel bearing that gives mine car wheels definite advantages not obtainable with any other bearing.

The method of mounting these bearings, as shown above, is another New Departure development. Rubber rings cushion axial shock loads and also compensate for variations in track gauge.

This new development gives longer wheel life, minimizes wear, power waste, repair and maintenance cost.

Write for new publication entitled "New Departure Ball Bearings in Mine Transportation Equipment". Sent upon request.

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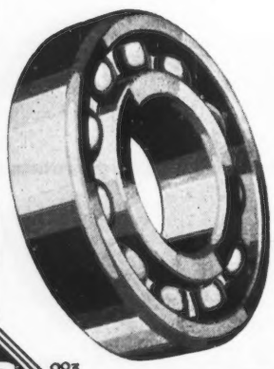
Whenever you have a bearing problem our expert engineers will be glad to discuss it with you personally. We will help you to do your thinking



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The American Metal Co., Ltd.

61 BROADWAY, NEW YORK

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Laucks Laboratories Inc., Chemists, Assayers, Metallurgists, Ore Testing, Umpire Sampling Import & Export Ore Shipments, 314 Maritime Bldg., Seattle, Wash.

Ledoux & Co., Inc., Assayers, Chemists and Metallurgists. Independent Samplers at the Port of New York. Representatives at all Refineries and Smelters on Atlantic Seaboard. Office and Laboratory, 99 John St., New York.

M

Moore, Geo. A. & Co., Assayers and Chemists, 212 California St., San Francisco. Control and Umpire Assays. Complete Ore Testing Laboratory, 615 University Ave., Berkeley, Calif.

O

Officer & Co., R. H., Ore Shippers' Service. Engineers' Assays, Controls, Umpires Iron and Steel, Oil and Coal Analyses. 169 S. W. Temple St., Salt Lake City, Utah.

P

Physical Exploration Corp., 111 Broadway, New York, and 1865 Monroe St., Madison, Wisc. Electrical and physical methods for exploration of ore-deposits. Technical direction: Mason, Slichter & Hay.

Pires, W. L., Assayer and Chemist. Rare Metals and Analyses. 1542 Court Place, Denver, Colo.

Pitkin, Inc., Lucius, Weighers, Samplers and Assayers of Ores of all Descriptions. 47 Fulton St., New York. Cable Niktip.

R

Richards & Locke. See Professional Directory.

Richards & Son, J. W., Assayers and Chemists. 1118 9th St., Denver. Ore Shippers' Agent. Write terms. Representatives at Colo. smelters.

Root & Simpson, Established 1902. Metallurgical Chemists and Assayers. 1306-1308 East 17th Ave., address P. O. Box 2069, Denver, Colo.

S

Schlumberger Electrical Prospecting Methods, 62 Front St. W., Toronto 2, Ont. Telegr. "Elecpropec." Tel. Main 1870.

Sill, Harley A., Consulting Engineer. 1011 South Figueroa St., Los Angeles. Examinations, Management, Geology, Ore Testing, Research, Mill Design. Consulting Engineers and Managers for Mining and Milling Operations. Metallurgical Plant equipped for large scale test work.

Southwestern Engineering Corp., Consulting Engineers. Examinations, Electrical Surveys, Research, Management. Ore testing 25 lbs. to carload lots. Mills designed, erected and operated. 606 S. Hill, Los Angeles, Calif.

Strickler, Letus S., Successor to C. A. Luckhardt Co., Established 1878, Assayers and Analytical Chemists, 627 Commercial Street, San Francisco, Calif.

Swedish American Prospecting Corp., 26 Beaver St., New York City. Rogers, Mayer & Ball, Consulting Engineers. Sole licensee for North, South and Central America under the Lundberg, Sundberg and Conklin patents for making electrical and electromagnetic investigations to locate mineral deposits. Cable: Isopotent.

T

Taumac Corp., The. 342 Madison Ave., New York City. Electric and Electromagnetic Surveys. Cable address Taumacorp.

U

Union Assay Office, Inc., Assayers and Chemists. Box 1446, Salt Lake City, Utah.

W

Waring & Williams, Industrial and Analytical Chemists. Analyses, Tests, Metals, Ores, Zinc-Lead Reports. Joplin, Mo.

Wood Assaying Co., Henry E., established 1878, Assayers and Chemists. 1750 Arapahoe St., Denver, Colo. P. O. Box 1318.

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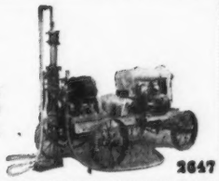

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IF YOU are qualified for position between $2,500 and $25,000, and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established seventeen years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not an employment agency. Retaining fee protected by refund provision as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 264 Main Street, Buffalo, New York.

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WANTED IMMEDIATELY, smelter chemist, Mexico, $200; mechanical engineer-draftsman, $200-$250; mill superintendent, lead and zinc, Arizona, $250; assayer-chemist, $200; underground mine superintendent, Canada, $200; mine superintendent, Idaho, $250; mine mechanic, New Mexico, $150-$175, tool sharpener, Ingersoll-Rand sharpener, temper and forge bits, make shanks, $150; sheet metal worker, $150. Write experience, age, etc. Business Service Company, Boston Building, Denver, Colorado.

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ACCOUNTANT thoroughly experienced all departments mine, mill and smelter accounting wants permanent position. Salary and location open. PW-799, Engineering & Mining Journal, 883 Mission Street, San Francisco, Calif.

CONCENTRATOR superintendent, metallurgist, 9 years' experience flotation copper, zinc, selective lead-zinc ores; 3 years in large research laboratory testing oils and ores; technical graduate; single; Spanish. PW-798, Engineering and Mining Journal, 7 So. Dearborn St., Chicago, Ill.

EXPERIENCED mill foreman desires position. Years of experience, cyanide and flotation. Speak Spanish. Available 10 days. PW-816, Engineering and Mining Journal, 883 Mission St., San Francisco, Calif.

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Located in a great mining and metallurgical center and offering four-year courses and graduate courses in General Mining, Coal Mining, Metallurgy and Petroleum.

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1928-1929

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The principal companies operating in Arizona are co-operating heartily with the University, offering their plants as laboratories to the men taking this course. They even give leave of absence to such of their technical staff as desire to avail themselves of this opportunity. Last session's travel of class was ever 4,000 miles. Arizona produces about 25% of the world's copper.

The course is under the personal direction of Dr. E. P. Mathewson, a former President of the American Institute of Mining and Metallurgical Engineers and for many years Manager of the Anaconda Copper Mining Company's plant at Anaconda, Montana.

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Dean and Director **TUCSON, ARIZONA**

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ELECTRICAL construction and operation; 20 years' experience (10 foreign); all around, electrical, mechanical; graduate E.E. course. Can supervise and personally instruct if skilled help is not available. Anywhere. PW-801, Engineering & Mining Journal, Tenth Ave. at 36th Street, New York.

ELECTRICAL mechanic, 3 years college, 10 years' experience, prospecting mining, telephony, electrical construction, designing, office supervision; 27, energetic, adaptable. Best references from previous employers. Now with large engineering corporation. Wish to return to mining field. PW-811, Engineering & Mining Journal, Tenth Ave. at 36th St., New York.

ENGINEER-GEOLOGIST. Graduate, 34, 12 years' metal mining experience in various large tonnage mines in Western U. S. as miner, chief engineer and chief geologist. Qualified to superintend the exploration and development work on a new or large property. Will consider any location. Available 15 days' notice. PW-814, Engineering and Mining Journal, 883 Mission St., San Francisco, Calif.

FLOTATION operator, lead-zinc experience, excellent references, desires place Mexico or South America; speaks Spanish. PW-805, Engineering and Mining Journal, Tenth Ave. at 36th St., New York.

MECHANICAL engineer, 32, college graduate, European training:; 3½ years' experience with mechanical and electrical mining equipment in this country; capable of taking charge of mining equipment maintenance, desires new connection with growing mining enterprise; available on reasonable notice. PW-815, Engineering and Mining Journal, Tenth Ave. at 36th St., New York.

MINING ENGINEER, six years' experience operating and managing mines underground and open pit. Will accept position anywhere if living conditions favorable for family. PW-797, Engineering & Mining Journal, 7 So. Dearborn St., Chicago, Ill.

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MINING engineer, technical graduate, with 7 years' practical mining, milling and construction experience, desires opening with company in the metal mining line. Available at once. PW-813, Engineering and Mining Journal, Tenth Ave. at 36th St., New York.

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1—48-in. Symons Disc.
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1—94-ft. centers, 14-in. belt, complete.
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1—10x20 Allis-Chalmers Blake Type Jaw Crusher.
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1—Set 36 in. 16 in. Colorado Iron Works Crushing Rolls

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1—7x11-in. Dodge Crusher.
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1—No. 1 Traylor Sample Grinder.
1—Size F, Gyratory Sample Grinder.

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No. 6 McCully
No. 6 Kennedy
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1—Steam hoist, contractor's type without boiler, 7¼x10 cylinders, double drum.

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6x60-ft., 6x70-ft., 6x100-ft., **Rotary Kilns.**
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No. 0, No. 1, No. 1½ and No. 2 **Sturtevant Rotary Fine Crushers.**
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Jigs, Concentrating Tables, Screens, Air Separators, Elevators, Ball and Tube Mills, Swing Hammer Mills.

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SW-810, Engineering Mining Journal
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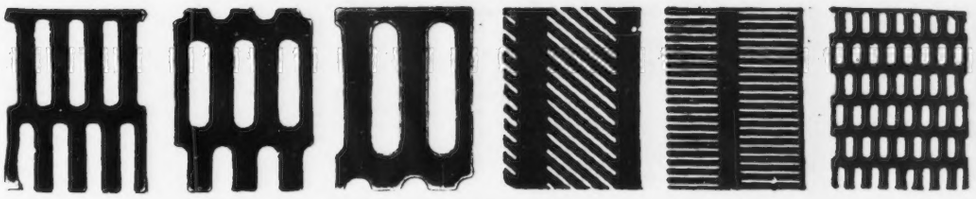

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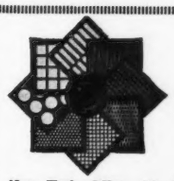

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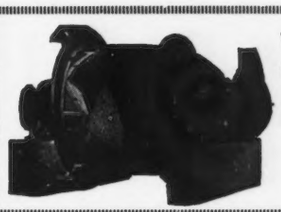

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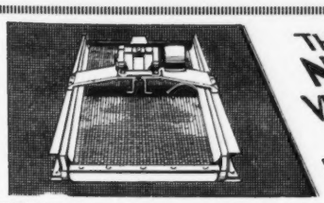

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[For Alphabetical Index See Last Page]

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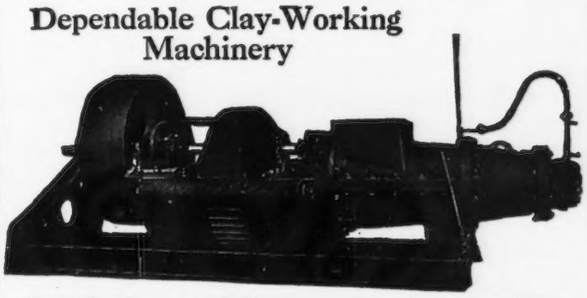

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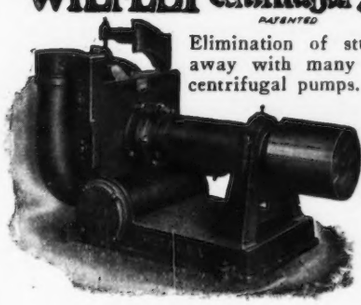

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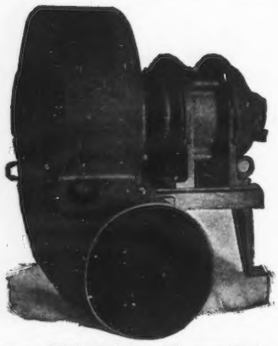

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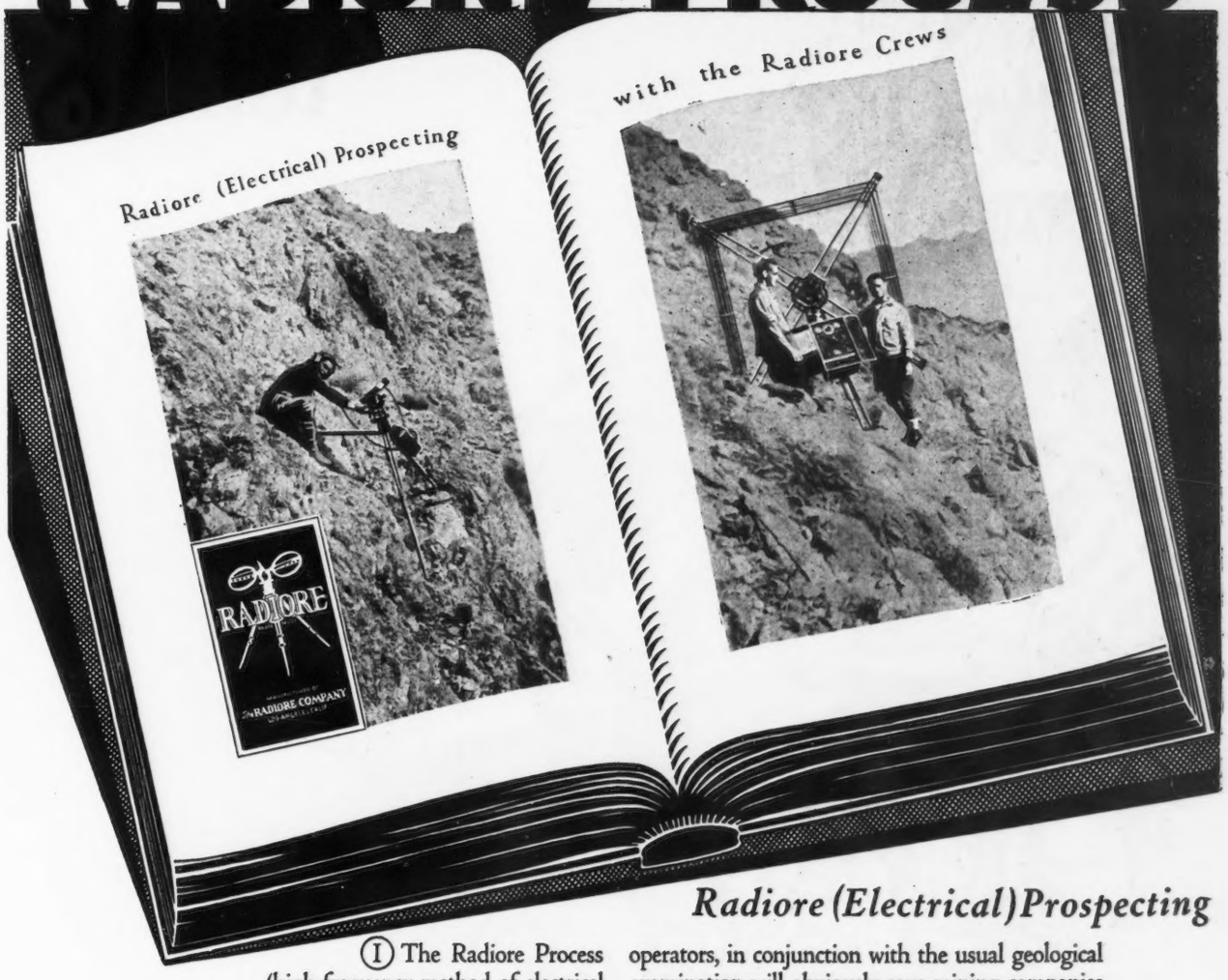

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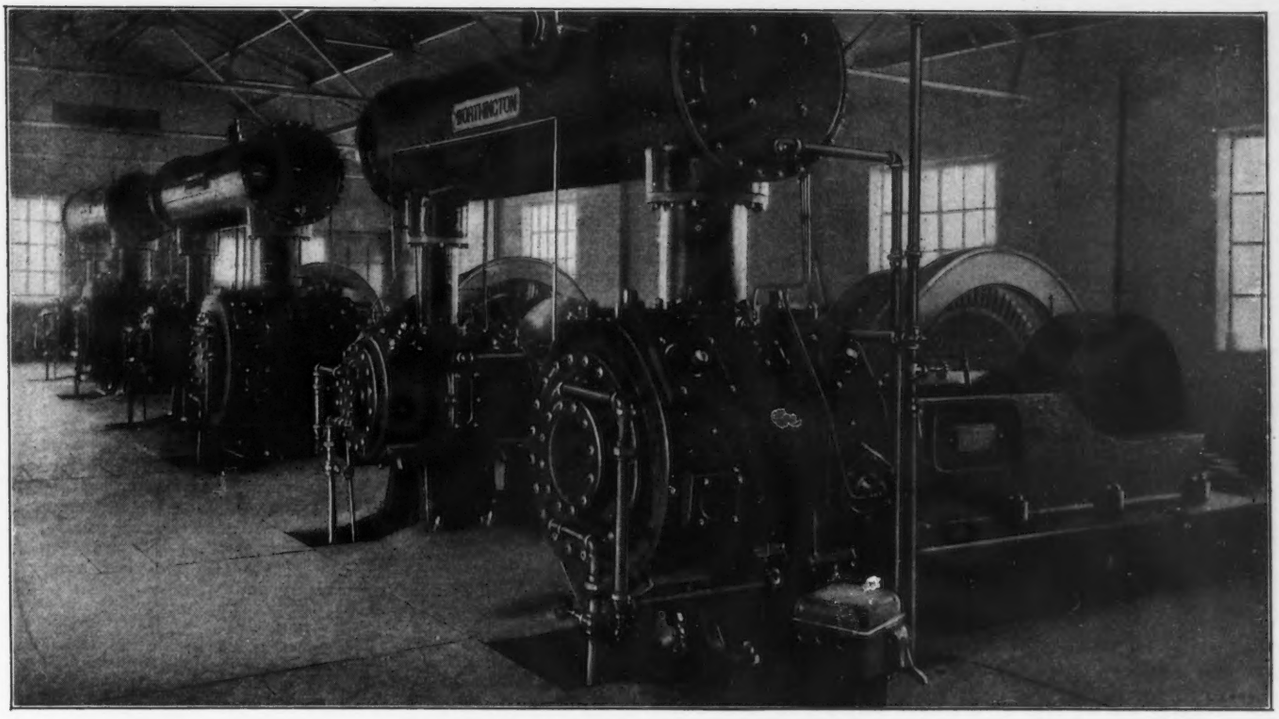

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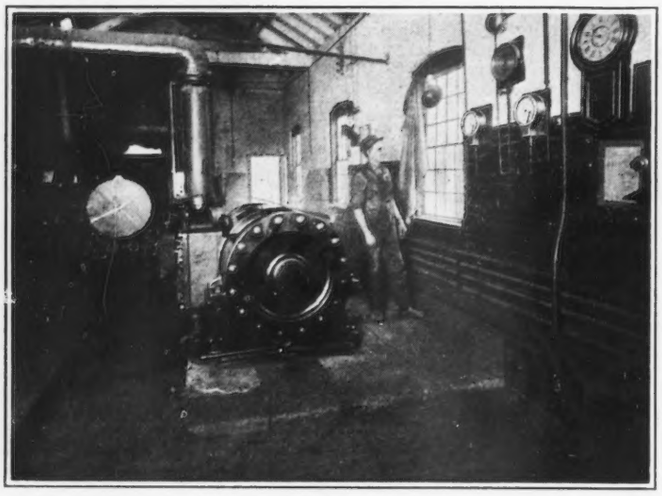

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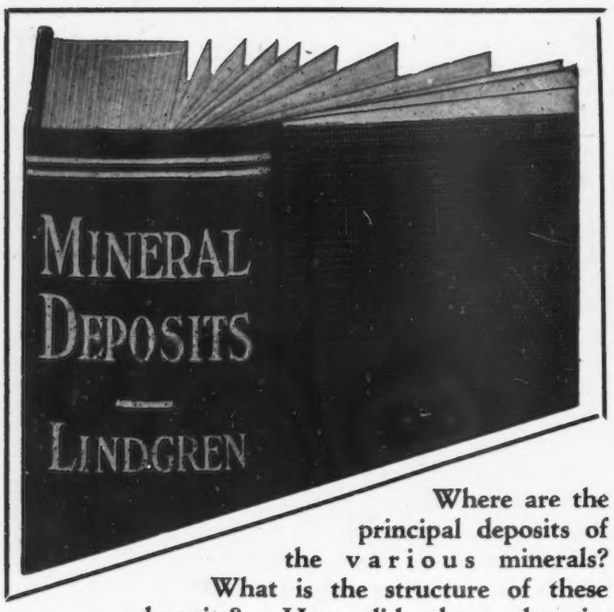

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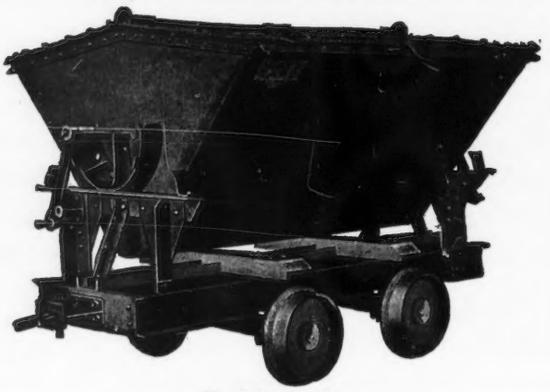

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Since 1863

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Selling "Watt Quality Products"

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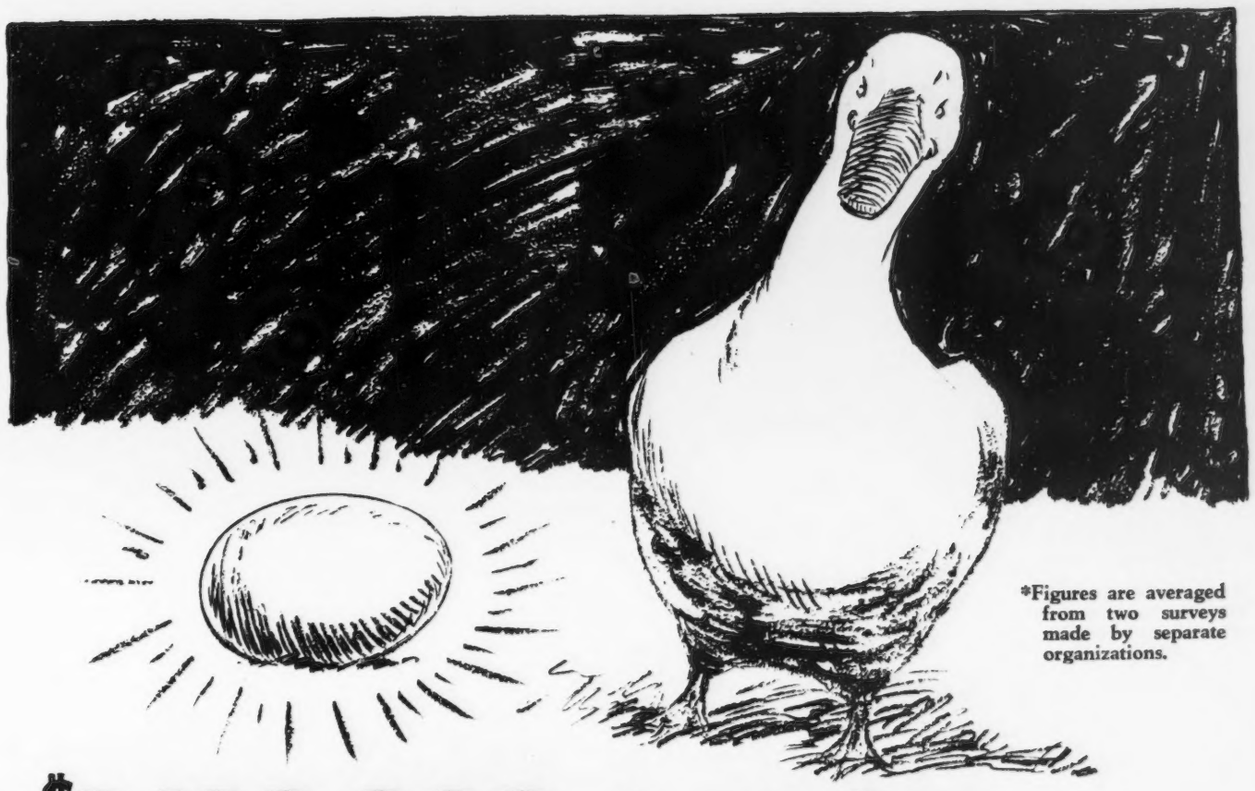


*Figures are averaged from two surveys made by separate organizations.

$2,100,000 A YEAR IN CRUSHER REPAIRS

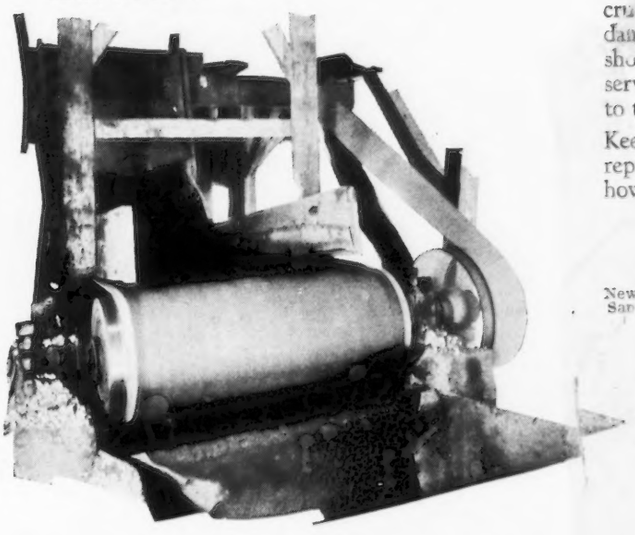
—that's why crusher manufacturers don't want magnetic separators

TWO million, one hundred thousand dollars a year* in repairs is a nice business for crusher manufacturers. That's why they don't want magnetic separators eliminating crusher-wrecking tramp iron. Why kill the goose that lays the golden egg?

Stop this source of loss—this paying two to three times for crushers. Dings Magnetic Separators absolutely prevent damage from tramp iron—the spikes, broken-off drill heads, shovel teeth inevitably picked up in ore. More than 8500 in service in rock handling, mining, and other industries testify to their value.

Keep the money now going to crusher manufacturers for repairs in your own pocket. Let Dings engineers show you how easily it can be done.

Dings Magnetic Pulley preventing damage to crushers by iron in plant of the Illinois Slag and Ballast Co., Joliet.



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Established in 1899

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Boston, 304 Rice Bldg.
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Dings High Intensity MAGNETIC SEPARATION

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EXPRESS trains speeding over gleaming rails—trucks groaning up steep inclines under heavy loads—powerful tanks, crushing all obstacles before them—all propelled with the aid of Traction.

And in the Dorr Traction Thickener, a small motor, plus traction, drives the raking mechanism—a mechanism which is strong and rugged, capable of handling heavy loads without trouble. These machines are built in sizes of from 20 ft. to 325 ft. in diameter, a single unit handling up to 16,000 tons of solids daily.

They can be used for any thickening or dewatering operation, such as thickening flotation concentrates, dewatering mill tailings, counter current decantation, etc.

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